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METALS AND METAL- WORKING IN OLD JAPAN.

BY

W. GOWLAND.

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THE
ONE HUNDRED AND FORTY-
SEVENTH ORDINARY MEETING
(SECOND OF THE TWENTY-FOURTH SESSION)

*Held in the Hall at 20 Hanover Square, W., on
Tuesday, March 2, 1915,*

Sir CHARLES HERCULES READ, President of the Society of Antiquaries, Member of Council J. S., in the Chair, when a paper on "METALS AND METAL-WORKING IN OLD JAPAN" was read by Prof. WILLIAM GOWLAND, A.R.S.M., F.R.S., F.I.C., F.S.A., etc., Member of Council of the Japan Society.

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METALS AND METAL-WORKING IN OLD JAPAN

By W. GOWLAND, A.R.S.M., F.R.S., F.S.A., late of the Imperial Japanese Mint), Emeritus Professor of Metallurgy in the Royal School of Mines, London.

FROM the evidence at present available, the Japanese appear to have migrated from the mainland of Asia through Korea to the islands they now occupy about seven or eight centuries before our era. The aborigines whom they found there were totally unacquainted with the use of metals. Hence all the earliest objects of metal which have been discovered in the country are Japanese, and are not older than that time. The evidence afforded by tumuli and dolmens, and the remains found in them of the early history and civilization of the Japanese, demonstrates clearly that in prehistoric times there were two periods which are more or less clearly defined by the progress which they had made in the art of metallurgy—viz. a Bronze and an Iron Age.

The Bronze Age begins with the immigration of the race, and terminates not long afterwards. The Iron Age then commences and extends to the present time.

It is worthy of note here that the Bronze Age and the first period of the Iron Age are also characterized by two distinct forms of sepulchral monuments—the former by barrows or simple mounds of earth, and the latter by megalithic dolmens and highly specialized forms of chambered tumuli.

There is no evidence whatever of a Copper Age preceding that of Bronze, but contemporaneous with the early Iron Age, and up to about the sixth century of our era, we find copper in more extensive use than bronze. Iron swords, trappings and bits of horses decorated with thin sheets of copper coated with gold, are found in abundance, whilst objects of bronze are rare.

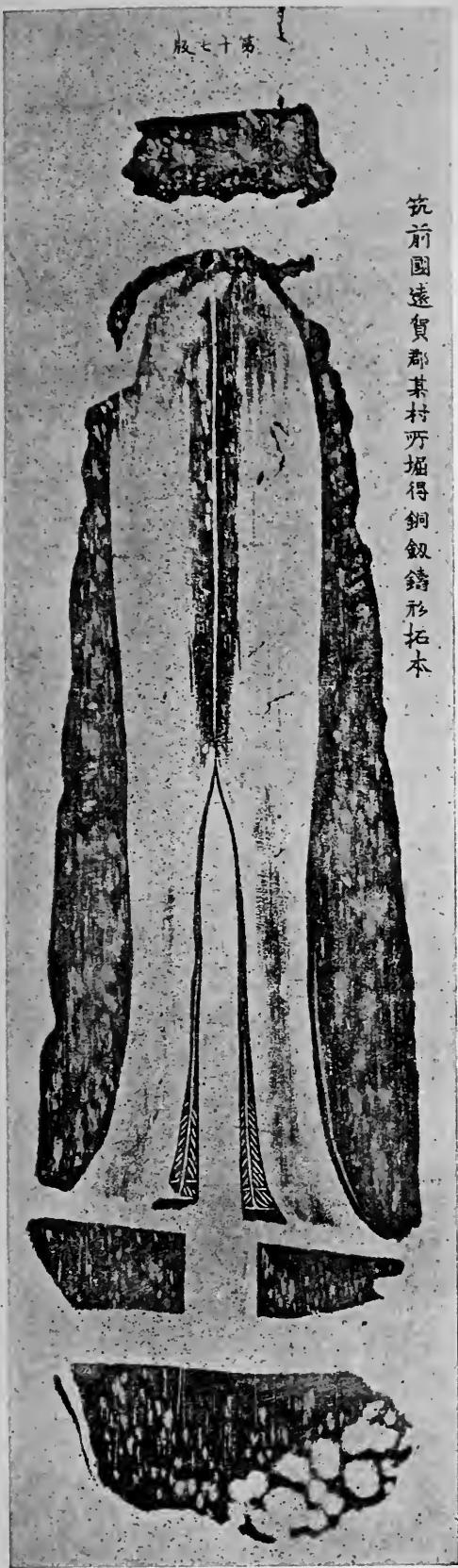


Fig. 1.—STONE MOULD FOR CASTING HALBERDS.

The most ancient examples of objects of metal in Japan are not simple celts or axes, as in nearly every other country in prehistoric times, but rather advanced two-edged bronze weapons, the blades of which resemble in form the swords of the prehistoric races of Europe.

One type of these is a halberd, the blade of which was set nearly at right-angles with the shaft. A mould for casting this weapon was found in Kiushu by a Japanese archæologist, which was being used by some farmers as a hone for sharpening their sickles. It is of stone, and in two pieces (fig. 1).

The other types are socketed spears or short swords (fig. 2), of which there are only a few rare specimens.

I may say here that on my visit to Seoül, the capital of Korea, I found stone moulds in regular use for casting simple silver articles, the stone being an indurated tuff.

I was unable to obtain any fragments or even scrapings of these weapons for analysis, as there are but few existing and they are highly prized; but a fragment of an arrow-head which I examined consisted of copper and tin, and did not contain lead as an

essential constituent, and the halberds and swords are probably of the same alloy. Both these forms of weapons represent an advanced stage of culture in the race and afford strong evidence in favour of the view that the Japanese were passing from the Bronze into the Iron Age when they first left the mainland of Asia.

It might perhaps be conjectured that they were the weapons of the aborigines who were conquered by the Japanese. But this view is untenable, as they have never been found in the northern and eastern provinces, to which the aborigines retired and which they held for a long period after they were driven out from the central and western parts of the main island.

Besides, all the evidence afforded by the ancient remains found in these provinces proves uncontestedly that the aboriginal race or races were in the Stone Age of their history and

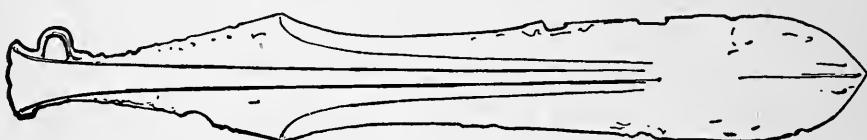


Fig. 2.—BRONZE SPEAR OR SWORD.*

were unacquainted with the use of metals when driven out by the Japanese.

The early Iron Age is characterized by the introduction of the interment of their warriors and notable dead in dolmens, megalithic stone chambers contained in a tumulus, a practice which continued to be followed up to the sixth or seventh centuries of our era.†

At the beginning of the Iron Age the race had passed beyond the stage in which they were merely hunting-tribes, and had become a highly civilized people, especially skilled in the working of metals and the fabrication of weapons of war.

The Japanese of the Dolmen Period were a race of warriors, and the art of war is chiefly represented in the remains.

It was then evidently regarded as a sacred duty that the

* Gowland, *Dolmens and Burial Mounds in Japan* ("Archæologia," Vol. LV. p. 475).

† For illustrations see Gowland, *Dolmens of Japan and their Builders* (Trans. and Proc. Japan Society, Vol. IV.).

arms and personal ornaments of the warrior should be interred with him, and also the trappings of his horse; and to these objects which have been found in the chambers of the dolmens we owe our knowledge not only of the metal-work, but of the stage of culture and civilization which had been attained during that period.

The metals I propose to deal with are gold, silver, iron, copper, and tin. These metals are the only substances recognized as metals proper by early Chinese and Japanese writers. They are designated collectively by a special term, *Go Kin*, which signifies the "Five Metals" and were supposed to have some mysterious relations with the "Five Colours," black, red, green or blue, white, and yellow, and also with the "Five Planets."

They were believed, according to Chinese philosophy, to have originated through the action of the sun and the masculine and feminine principles of Nature on the materials of the earth's crust, and not to be simple bodies or elements, but to be capable under certain conditions and influences of being transmuted one into another.

The methods of extracting and of working them and their alloys in Old Japan, and of fashioning them by means of simple and often rude appliances and processes into objects both for practical and ornamental uses, are of unusual interest and value to our craftsmen of the present day.

To the Western artist they exhibit an endless number of new motives, new expressions of art-thought, and a masterly adaptation of materials to decorative designs.

GOLD.

Gold is called by native writers the "King of the Five Metals," because, say they, it never rusts and can be melted many times without appreciable loss of weight.

Following the teachings of the old Chinese philosophers, it was believed that under special conditions other metals could be converted into gold, but this transmutation could not be effected in a laboratory, as a space of not less than two hundred years was required for its completion even under the influence of celestial agencies.

Probably in consequence of this belief in the all-important influence of time, the occult science of Hermes, Albertus Magnus, and other Western alchemists does not appear to have been practised in Japan; and much as the acquisition of gold was sought after, no records of any attempts to transmute a baser into the more noble metal have been handed down by tradition.

The source of the gold in Japan, as in all countries in early times, was the sands of rivers, from which the metal was obtained by a series of simple washing processes, which seem to have been conducted with much skill. At the present day some is still similarly obtained, and often from sands containing such small quantities that Western processes fail to compete successfully with the primitive methods of the Japanese gold-washers.

The old gold-washers are said to have received no wages: sufficient gold dust adhered to their garments; and it is naïvely added that sometimes even a nugget became accidentally attached, and this was sufficient to recompense them for their labours.

An account of an almost unique method of "getting" gold from river sands is given in the following letter which I received in 1901 from my friend and former assistant, Mr. O. Yamagata, now chief engineer of the Imperial Mint.

"Last summer I visited Shōkawa, a gold-dust district in Hida. Each man and woman, standing here and there in the river, about two to four feet deep, has an eyeglass consisting of a wooden box with a glass bottom. Looking into the glass placed on the water surface, whose wave disturbances are thus eliminated, they can clearly see the river-bed. Any gold piece thus sought is caught by a small clay ball attached to the top of a bamboo stick four to six feet long. Now and then the river-bed is disturbed with a kind of plough. They say that gold usually 'grows' in nearly the same part of the river! This is practically gold 'fishing.' "

In later times mineral veins bearing gold were discovered, and the precious metal was separated from them by the old methods of washing after the ores had been reduced to powder. The appliances used for crushing were of the simplest kind. The large pieces of rock were broken up with hand hammers

to the size of large walnuts, and then reduced to coarse powder by means of a curious form of stamp which was worked with the foot. The ore was further ground in a horizontal mill resembling a flour-mill or quern, and the powder was then

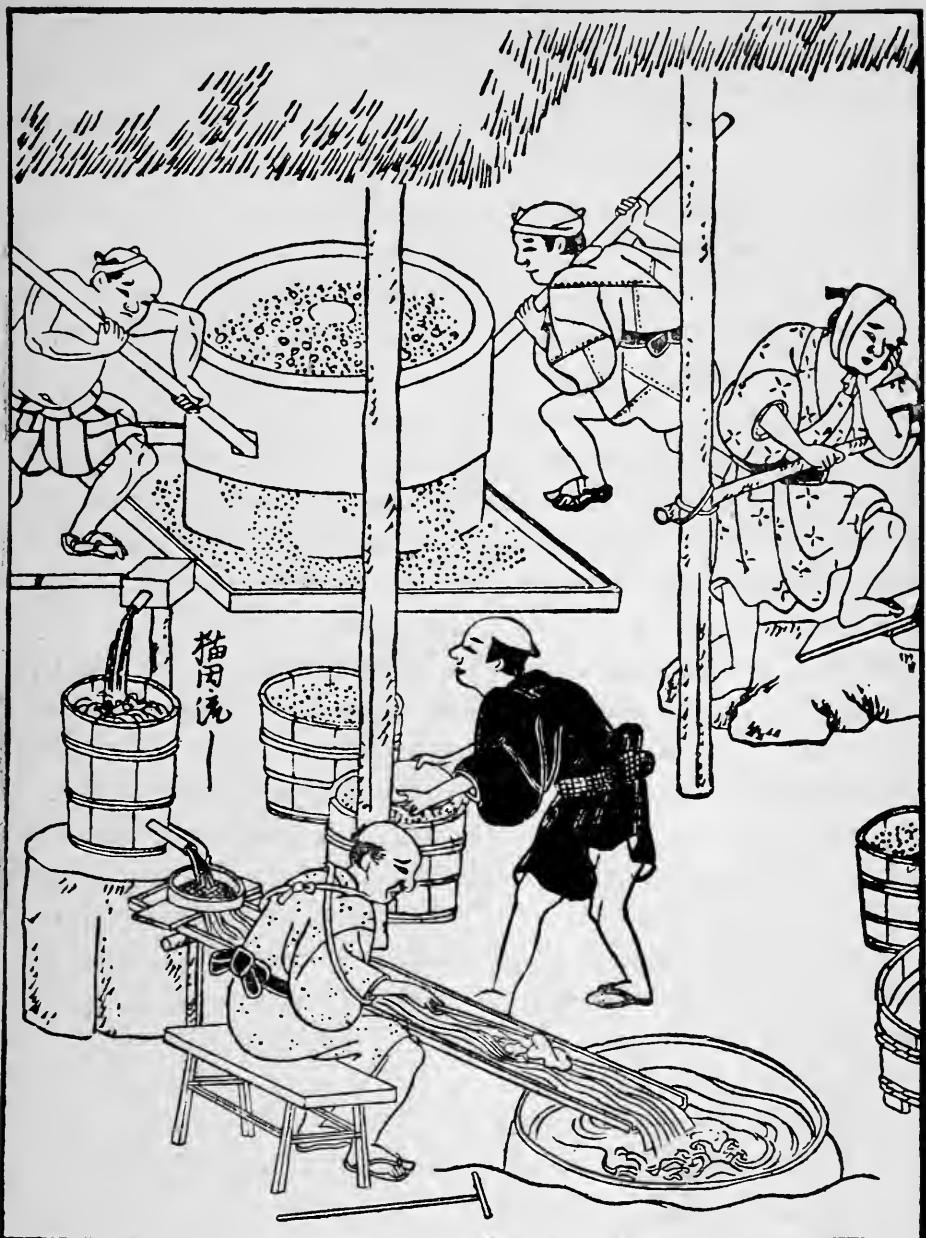


Fig. 3.—EXTRACTING GOLD FROM THE ORE (*Archæologia*, LVI.).

washed with water on an inclined trough, on the bottom of which long sheets of cotton-cloth were laid (fig. 3). The particles of gold were caught on the rough surface of the cloth, and the earthy material was carried away by the water.

The cloths, after a time, were washed in tubs of water and the gold obtained.

The metal, although found in many localities, was never abundant in Japan, and the glowing accounts of the early voyagers respecting the wonderful richness of the country in gold have no foundation in fact.

Doubtless they had their origin in the erroneous assumption that the ornamental plates and appendages which were seen to adorn so lavishly the principal temples and to form the architectural ornament of many ordinary dwellings were of solid gold, whereas they are only gilded copper. But the sumptuary laws recorded in ancient documents prove that gold was always a precious metal to be used sparingly. In the ninth century, by one of these laws, all officials below the sixth rank were forbidden to wear any gold or silver excepting on their armour and swords and official robes. The effects of these and subsequent similar laws survived almost up to recent times, so that the gold jewellery of a Japanese lady consisted merely of a simple hairpin, and that of a gentleman of the mounts of his sword, pipe, and tobacco-pouch.

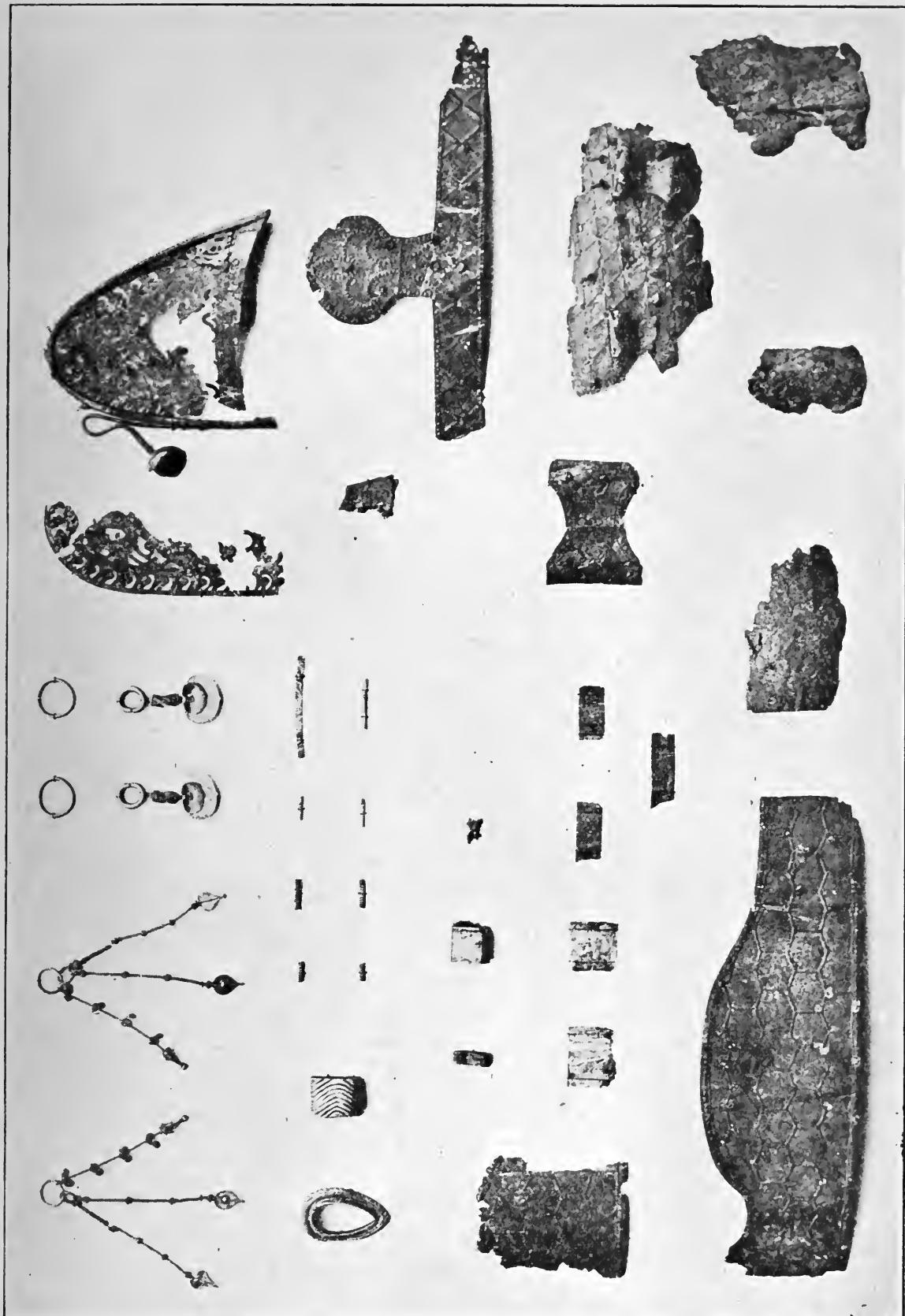
One of the earliest uses of gold was as a coating for other metals to protect them from oxidation and for purposes of display. Thus in the early centuries of our era we find it employed for coating bronze and copper rings and other objects for personal adornment, and iron horse-bits and ornamental appendages which were attached to the trappings of horses.

In its application to these purposes the Japanese of these remote times display extraordinary skill in the working of the metal, and in the art of ornamenting it with pierced and repoussé designs.

The most ancient examples of the use of gold are copper and bronze penanular rings called *kinkwan*, which are enclosed in thin sheets of the metal. One of these of bronze, from a burial-mound assigned to the second or third century B.C., is the earliest known to me.

Some remarkable specimens of this ancient metal-work that were taken from the chambers of a dolmen at Edamura (Higo) are in the Imperial Museum, Tokyo. Five Chinese mirrors were found together with the other objects, and from

ORNAMENTS FROM THE HIGO DOLMEN.





their designs they are either of the time of the Minor Han Dynasty (221-264 A.D.) or of the first half of the Tsin (265-419 A.D.). The date of the dolmen is not later than the beginning of the fourth century of our era.

The most important objects are illustrated in Plate II.*

A broad thin band of copper coated with gold, and ornamented with a hexagonal network pattern, executed in lines of closely punched dots. The decorative effect is increased by small circular pendants, suspended by wires from the angles of the hexagons. The numerous small perforations which it bears show that it had been attached with thread to the dress of the warrior or chief interred in the tomb.

An elaborately decorated tiara of gilded copper, partly in a fragmentary condition, bearing scroll designs in pierced work. It is the oldest example of pierced work yet found in Japan.

Two pendants and earrings of gold, the former having small beads of enamel-like glass mounted as gems at their lower ends.

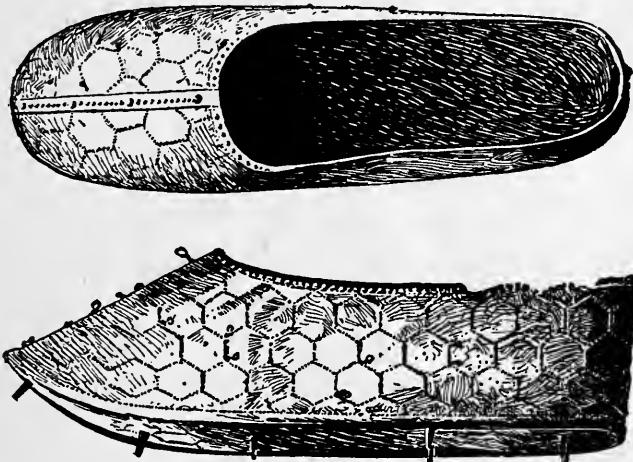


Fig. 4.—SHOES OF COPPER, COATED WITH GOLD.†
Length $12\frac{3}{8}$ inches.

Also shoes of copper (fig. 4) plated with gold and ornamented in the same manner as the band described above.

Of the same period are the horse-bits and the halberd-shaped ornamental appendages for the trappings of a horse

* Gowland, *Dolmens of Japan and their Builders* (Trans. and Proc. Japan Soc., Vol. IV. Plate XIII.).

† *Archæologia*, Vol. LV. p. 491, fig. 35.

which I obtained from a megalithic dolmen at Rokuya, in the province of Tamba.* The cheek-pieces of the upper bit are flat plates with a beautiful curved outline. Each consists of a plate of hammered iron, to the exterior of which, in order to protect it from oxidation, and for purposes of display, a thin sheet of copper, coated with gold, is attached by means of studs running round its margin.

The lower bit is of similar construction, but the plate is in the form of an eight-pointed star in pierced open-work.

The halberd-shaped horse ornaments also consist of iron plates covered externally with copper, coated with gold. I should state here that this coating of gold is not a mere film, but is usually of considerable thickness, and in fact it is owing to it that many of the metal objects of the early times are preserved, for the copper is often entirely converted into carbonates and oxide, none existing in the metallic state, and is only held together by the thin sheet of gold.

In addition to these I must not omit to describe two splendid specimens of the decorative use of gilded copper.

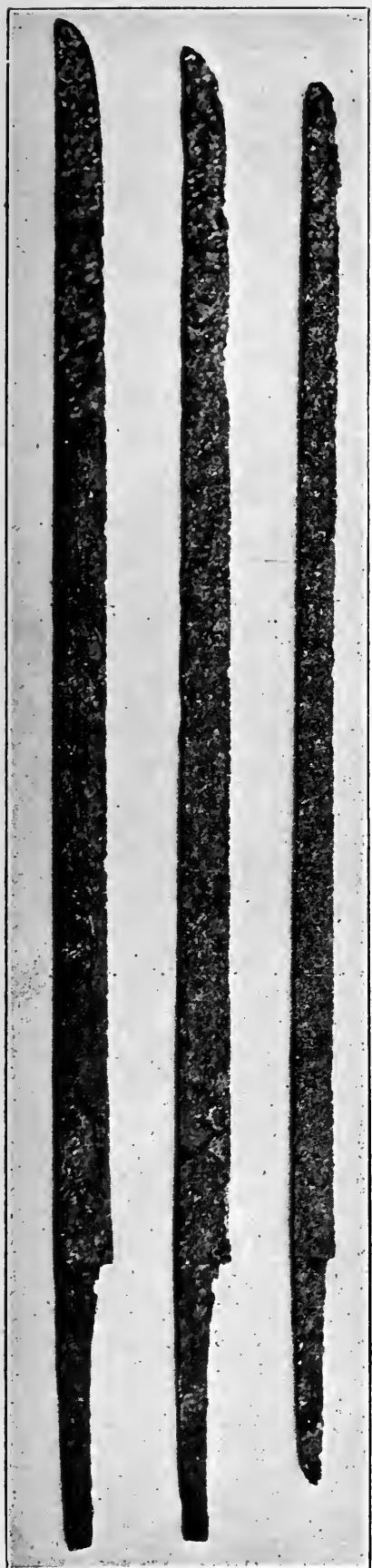
They are two swords† which were found in the chamber of a dolmen of the fifth or sixth century in the village of Omi, in the province of Musashi. They are especially remarkable for the richness of their ornament. The upper one is 2 ft. 6 $\frac{3}{4}$ in. long. The grip is of wood enclosed in copper plates coated with gold and decorated with fine punched scrollwork. The pommel is of a curious form and consists of the same metal expanded into a large bulb-like head.

The guard is also of copper coated with gold, and is pierced with the trapezoidal apertures characteristic of the Dolmen Period. Three broad bands and two rings of silver encircle the wooden scabbard, the latter having loops for the attachment of the cords by which the sword was suspended.

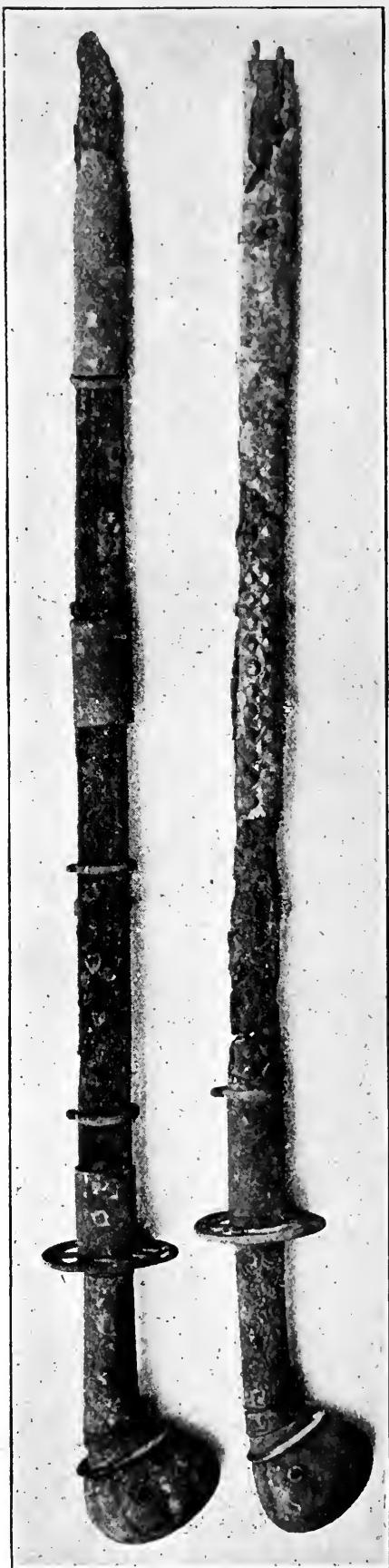
The other sword is similar to this, but the greater part of the body of the scabbard is covered with plates of gilded

* Gowland, *Dolmens of Japan and their Builders* ("Trans. and Proc. Japan Soc.", Vol. IV. Plate XII.).

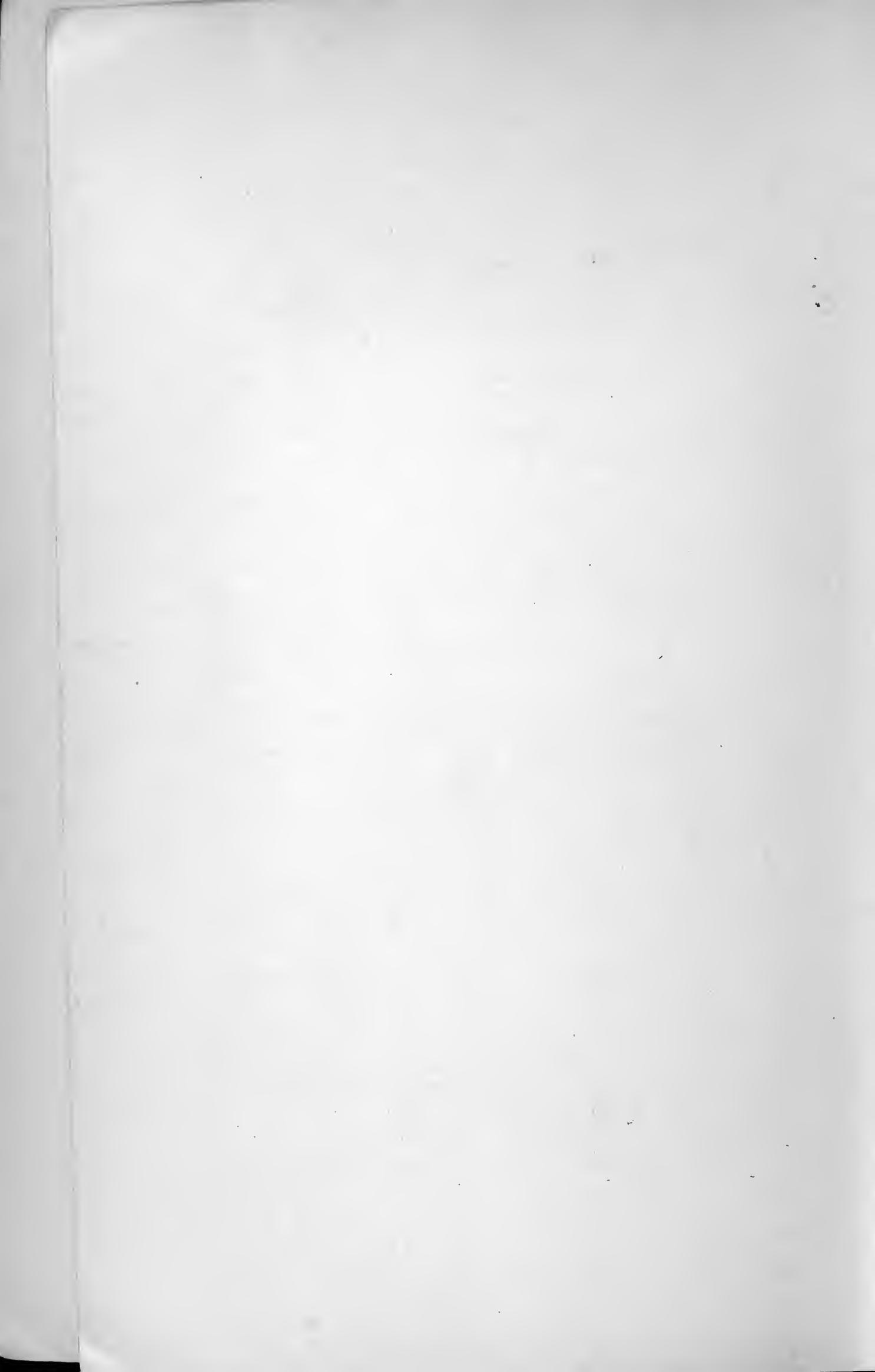
† *Ibid.*, Plate X. fig. 2, and Plate II. opposite.

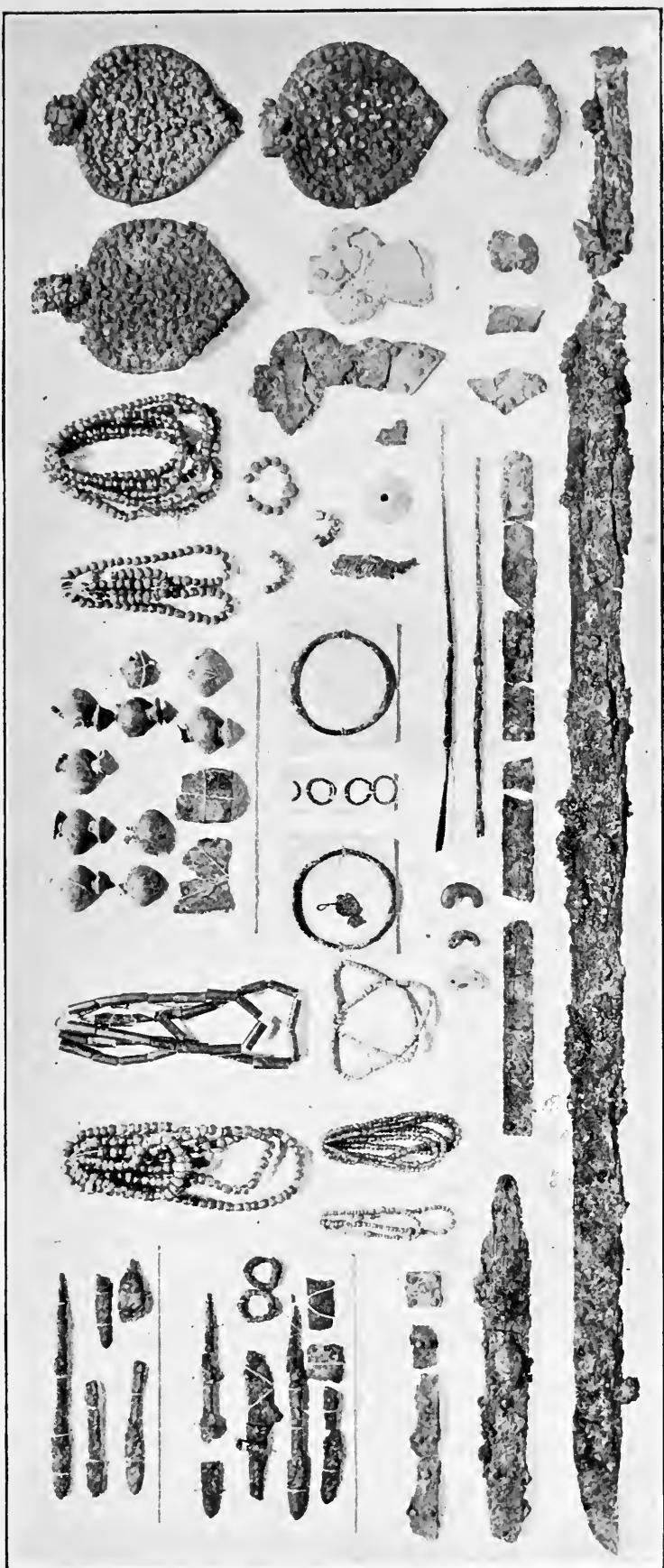


SWORDS FROM DOLMEN AT HIGO (Kawachi).

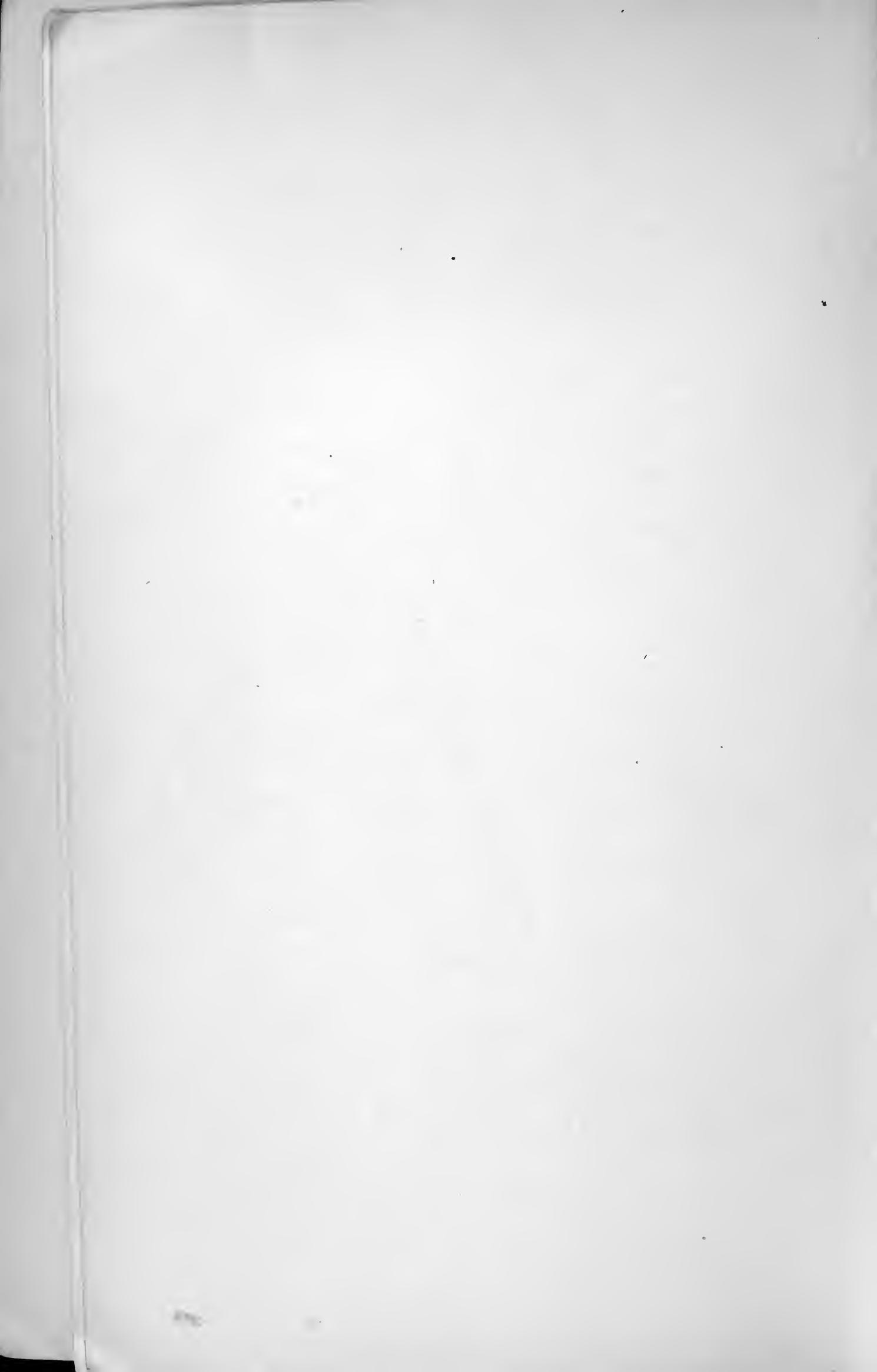


SWORDS FROM DOLMEN AT OMI (Musashi).





OBJECTS FOUND IN THE DOLMEN OF SHIBA (Kawachi).



copper, which are ornamented with bosses in repoussé work in high relief.

The craftsmen of this early period were already expert in the metallurgy and fashioning of metals, and not less skilful in the art of decoration. Their methods of covering iron for its protection and ornament with sheets of copper coated with gold, died out with them at the end of the Dolmen Period, and is never seen in later times.

Other examples of the metal-work of this time were described in my paper on "Dolmens of Japan and their Builders," in Vol. IV. of our "Transactions."

With the introduction and establishment of Buddhism in the sixth and seventh centuries, gold comes into use on a more extensive scale, but even now very rarely were articles made of solid gold, its chief application being for the gilding of bronze and wooden images of Buddhist Divinities, of copper vessels for ceremonial and ornamental purposes, and of copper plaques for the decoration of shrines.

Considerable quantities of gold were needed for these purposes, as the leaves of metal employed were of much greater thickness than those now used in Europe.

The method by which the surfaces of copper and bronze were coated with gold necessitated the use of mercury; and as the ores of this metal had not then been found in Japan, there is little doubt that the process had been introduced from China, where it seems to have been known for many centuries B.C. The process is a very simple one. The object of copper or bronze to be gilded was immersed in vinegar made from the juice of unripe plums until a clean metallic surface was obtained. It was then washed and dried over a brazier, and mercury was applied to it whilst it was still hot. When the surface had been thus amalgamated, the gold was laid upon it in the form of leaves. A stronger heat was then applied, the mercury was volatilized, and the gold left perfectly adherent.

During somewhat later times the most important use of the metal was as a medium of exchange, for which purpose it was employed in the form of gold-dust enclosed in quills or small bags, each containing a definite weight.

The sixteenth century is chiefly remarkable in the annals.

of gold for the first coinage of the metal by the Government of Japan. No specimens of gold coins of an earlier date are in existence, and although they are said to have been occasionally made in the Daimiate Mints, tradition, usually so prone to refer to remote times all its records, does not ascribe to any a great antiquity. The first Government Mint for the coinage of gold and silver money was established between 1570 and 1580 A.D.

One of the first issues of this Mint was the Oban, or, specifically, *Tensho-oban*, Tensho being the name of the chronological period during which it was made. It is a very large coin in the form of an oval plate measuring nearly seven inches in length and about four inches in breadth, its average weight being 5·3 troy ounces, and its average composition 73·84 per cent. gold, 24·00 per cent. silver. Its actual value in our money is £16 16s. 6d. There were also smaller coins, which were used for making ordinary payments.



Fig. 5.—HOMA 法馬.

In addition to the production of coins, it was always a function of the Mint to prepare for the Government from time to time large bars of gold called *homa* (fig. 5), which were

to be kept in the Treasury as a reserve against famine, war, or other calamities. These bars were of the form of an ancient weight, and were approximately of the following dimensions : Length, thirteen inches; breadth, six inches; and thickness, five inches. Each of them usually bore an inscription stating that it must not be used for ordinary expenditure, but only for the requirements of war or famine. The inscription on some was, "Peace and treasure endure together," meaning that a reserve against war is a guarantee of peace.

The first record we have of these bars is in the Manji period (1658-1660), when a large number were made from native gold (gold-dust) for the expenses of the army and defence of castles, and for use in calamities. They were also made during the Kwansei Period (1789-1800), and as late as the Tempo Period (1830-1843), for military expenses.

The methods pursued in the early Mints for the production of coins are of special interest, as they are for the most part identical with those practised by all workers in gold and silver from those times up almost to the present day, and several are unique in the art of metal-working.

As the gold obtained at the different mines was by no means of uniform composition, it was necessary on its arrival at the Mint to determine the actual proportions of gold present in it. The assay was performed by means of the touchstone and a series of small bars or plates of gold alloyed with definite proportions of silver according to a decimal scale. These "trial" plates were prepared by the Government, and were used not only in the Mint, but all goldsmiths' wares are said to have been compared with them in order to determine their fineness.

The touchstone is a small flat piece of black siliceous shale. The gold to be assayed was rubbed on the smooth surface of the stone, and the colour of the streaks produced was compared with similar streaks made near them by rubbing on it one or more of the definite alloys. No acids or chemicals were used. This method is still practised by gold-workers in Japan, and by it a skilful expert will obtain results not differing in extreme cases more than ten parts in a thousand from assays made by our methods, when the gold is only alloyed with silver.

This method of valuing gold has survived from very ancient

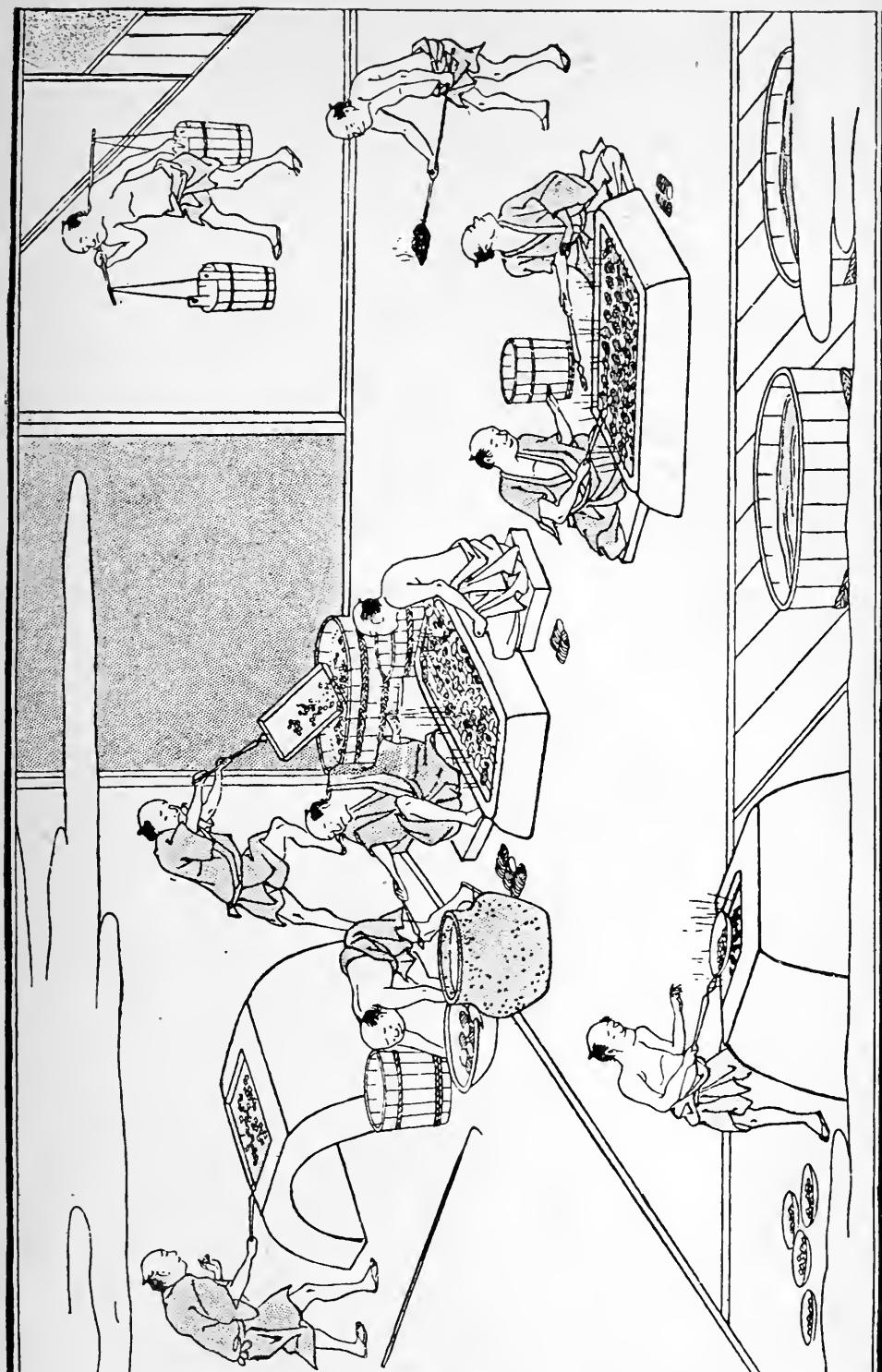
times. It was certainly in use by the Greeks as early as 500 B.C., although the earliest written account of it and of the kind of stone employed is that given by Theophrastus in the third century B.C.

Owing to the large proportion of silver which the coinage alloys contained, the coins were still nearly white in colour, and it was necessary to give to them a surface of gold. This was effected not by any ordinary gilding process, but by dissolving out the silver from the upper layers of the alloys (Plate IV.). The coins were first painted with a mixture composed of iron and copper sulphates, potassium nitrate, calcined sodium chloride, and resin made into a paste with water. They were then carefully heated to redness on a grating fitted over a charcoal fire. After this they were immersed in a strong solution of common salt, washed with water, and dried. Their surfaces now consisted of a layer of pure gold. This process was followed by the old workers in gold, and with trifling modifications is still practised at the present day.

Objects of solid gold, excepting those of very small size, were still seldom made. Gold plate was unknown, and even in the palaces of the wealthiest military nobles the only vessels of the precious metal, either for use or display, were a few wine-cups and diminutive kettles for heating water or wine, and these were by no means common.

The only large vessels of gold known to me are two caskets which were in the Shinto temple of Ama-terasu, the Sun-goddess in Ise. Placed in the Holy of Holies of the innermost shrine and containing Divine Emblems, they were never seen excepting by the chief priest, who alone had the privilege of entering this most sacred portion of the temple. In 1883 it was decided that they should be melted and replaced by others, and the honour of preparing the new vessels was accorded to the Mint. The old caskets were two simple cylindrical covered boxes, entirely without ornament of any kind, probably not older than the seventeenth century, as on assaying them I found that they were composed of 67·8 per cent. gold and 29·3 per cent. silver, a composition identical with that of the coinage of that date. Their weight was 291 oz. and value £840 sterling.

The new vessels were made, of similar form to the old, of rolled sheets of gold riveted with gold pins. (The alloy, which



COLOURING GOLD COINS IN THE MINT (early XI.Xth century).



was used in accordance with my suggestions, was 90 gold, 6 silver, and 4 copper.)

Gold jewellery in our acceptation of the term was, as I have already stated, worn but sparingly, so that the use of gold in the art of the metal-worker was practically confined to the decoration of the furniture of the sword and the fittings of the pipe and tobacco-pouch. But as late as the fifteenth century gold was used sparingly even for the furniture of the sword except for *menuki*, its application being chiefly confined to the inlaid decoration of *shakudo*. *Kogai* and *kozuka* of solid gold are extremely rare. In the first half of the seventeenth century, during the time of the Shōgun Iyemitsu (1623 to 1651), however, a period of luxury appears to have prevailed, and *kogai*, *kozuka*, and even *tsuba* were sometimes made of gold. The same is true of the last half of that century, but only two *tsuba* of gold are in existence. The fineness of the gold employed in making the *kozuka* and *kogai* by members of the Gotō family ranged from 77 to 83 per cent. of gold.

The small ornaments, *menuki*, attached to the sides of the grip of the sword were often made of gold of greater purity. One specimen which I analysed contained—gold 98·1 per cent.; silver 1·4 per cent.; copper and lead 0·5 per cent.

For objects generally, alloys of gold with silver, containing less gold and approximating in composition to the Mint coinages were usually employed. In the seventeenth century their composition sometimes reached 84·6 to 87·8 per cent. gold. In the eighteenth the amount of gold present occasionally falls as low as 65 per cent.

In the nineteenth century extremely poor alloys may be found in which the proportions of gold are reduced to 35 per cent. (8 carats) and even to 12·3 per cent. (3 carats). Yet, from the peculiar treatment to which objects of even these poor alloys are subjected, they are indistinguishable in external appearance from those of pure gold.

The earliest method of decorating iron with gold was to cover its surface with a thin sheet of copper, which was subsequently coated with the metal as described on page 29.

It was in extensive use, as we have already seen, in the early centuries of our era, but almost contemporaneously the Japanese seem to have become acquainted with the process of

"onlaying," by which gold is affixed directly to the surface of the iron. This process seems to have been carried out by the early craftsmen in the same manner as at the present day. The surface of the metal is roughened by cutting fine lines in it with a chisel in the form of cross-hatching. It is then carefully heated, and whilst hot a sheet of gold of suitable thickness is laid on the roughened part and made firmly adherent by hammering lightly and rubbing with a smooth stone.

This is the most ancient method of the direct application of gold to the decoration of iron surfaces. But one example of its use has been found in the Dolmen Period, in what seem to be rude ideographs, quite undecipherable, which ornament the back of one of the swords from the Higo Dolmen.

I should not, however, omit to state that no craftsman devoted himself solely to work in the precious metals. There was no special guild of goldsmiths or silversmiths: all art metal-workers were content to work in any metal, their sole desire being to produce objects which should be valued for their beauty alone. The value of the material was secondary; originality of design, grace in ornament, and skilful handicraft were paramount; and so true is this, that it is not in gold and silver that we find the most famous masterpieces, but in less costly metals and alloys. In this the Japanese craftsman is a true artist.

Another use to which gold has been applied, and which is peculiar to Japan, is the decoration of lacquer.

SILVER (Jap. *Gin*).

"*Gin*," or, as it sometimes called, *shiro-kane*, "the white metal," has been in use in Japan from an early period.

In the history of culture the discovery of silver and the application of the metal to useful purposes play a minor yet by no means an insignificant part. Less widely distributed than copper, and wanting in the properties which made bronze so valuable for implements and weapons, it seems to have been but little used in the world until a few centuries before Mycenæan times.

In North Europe silver was almost entirely unknown, or at least unused, in pre-Roman times, and even in South Europe it is of rare occurrence in the Bronze Age.

It might be supposed that the paucity of discoveries of silver objects of very remote times might be due to the destructive action of the weather, or of salts in the soil, on the metal. This is, however, by no means true. The metal resists well the action of all corrosive agents commonly present in the air, rain, and soil, excepting chlorides. In rain chlorine as sodium chloride is always present ; it is also present in the soil. Hence, silver objects which have been long buried are always more or less converted into silver chloride. Sometimes they are wholly changed into this substance, but generally a small unaltered core of silver exists within them which enables them to retain their shape. Even when completely changed into silver chloride their form is more or less retained ; silver chloride, however, although comparatively soft and sectile, is a very indestructible substance, so that even these ought to be found.

For the earliest use of silver there is much evidence to show that we must pass eastward out of Europe into Asia ; but in which parts of Asia lay the original home of silver, whether in the east in China or in the west in Asia Minor, the data for arriving at an absolutely definite conclusion are insufficient.

The earliest use of the metal has been claimed for China, where as early as 2400 B.C. three metals are said to have been used as barter—the yellow, the white, and the red—namely, gold, silver, and copper. It was without doubt known in that country in very remote times ; but Chinese chronology, whilst possessing the quality of precision, lacks that of accuracy, so that it is quite impossible to assign an even approximate date to most of the records contained in the ancient books.

But it is almost certain that for the oldest objects of silver yet found we have to go to Western Asia, where some remarkable specimens of early work in silver have been unearthed by the excavations of Schliemann at Hissarlik, which, in fact, if the dates attributed to the strata in which they were found are correct, are the most ancient examples of wrought silver in the world. They consist of a silver pin and earring and a piece of wire, which were found in the lowest city to which the date 3000 to 2500 B.C. has been ascribed by Tsountas and Manatt.

In a higher stratum, containing the remains of the Third City (2500 to 2000 B.C.), the prehistoric fortress of Dörpfeld,

there was quite a wealth of silver vessels and objects, comprising eleven vases, goblets, jugs, etc., six silver bars, and some personal ornaments, as well as crucibles in which gold and silver had been melted.

The first examples we have of the use of silver in Japan are of much later date : they are bronze and copper rings coated with silver, bands of the metal encircling the scabbards of swords, also beads for personal ornament, several of which I discovered in the chambers of the ancient burial-mounds.

How far the semi-mythical traditions which point to Korea as the source from which the Japanese obtained their first silver are trustworthy we have no conclusive evidence to prove, but it is certain from the objects found in the burial-mounds that the metal, from whatever source it was obtained, was worked in Japan as early as the first centuries of our era.

The metal silver is, like gold, found in the native state—*i.e.* as pure metal ; but in that form it has only a very limited distribution, and only occurs rarely and in very small quantities in Japan. Alluvial deposits, or the sands and gravels of rivers, do not contain it, and it has to be sought for in mountain regions, where it is embedded in mineral veins.

The ores from which the metal was first obtained were undoubtedly either ordinary lead ores, in which it is invariably present, or silver ores containing considerable amounts of lead, but during the last two or three centuries it has been obtained from copper ores.

In the absence of lead, the silver could not be extracted by any process until comparatively recent times.

The chief ore of lead (galena) is of very common occurrence in Japan, and it is always argentiferous.

The first and essential process, then, for the extraction of silver was the process of smelting ores for lead, the product being always the latter metal, containing the former dissolved in it in greater or less proportions.

The furnace employed in Japan for that purpose is practically identical with that used for smelting copper ores, but is sometimes of slightly greater diameter.

The smelting, too, was conducted in a similar manner except that the reduced metal was laded into moulds.

The process in operation as it was conducted in Japan is illustrated in fig. 6. The clay moulds are shown in front and the bellows behind the furnace, which is simply a hemispherical hole in the ground. The process is a very wasteful one. A considerable amount of lead is volatilized. A large quantity, too, passes into the slags and is also lost. So wasteful, in fact, is this primitive method of smelting, that at several mines

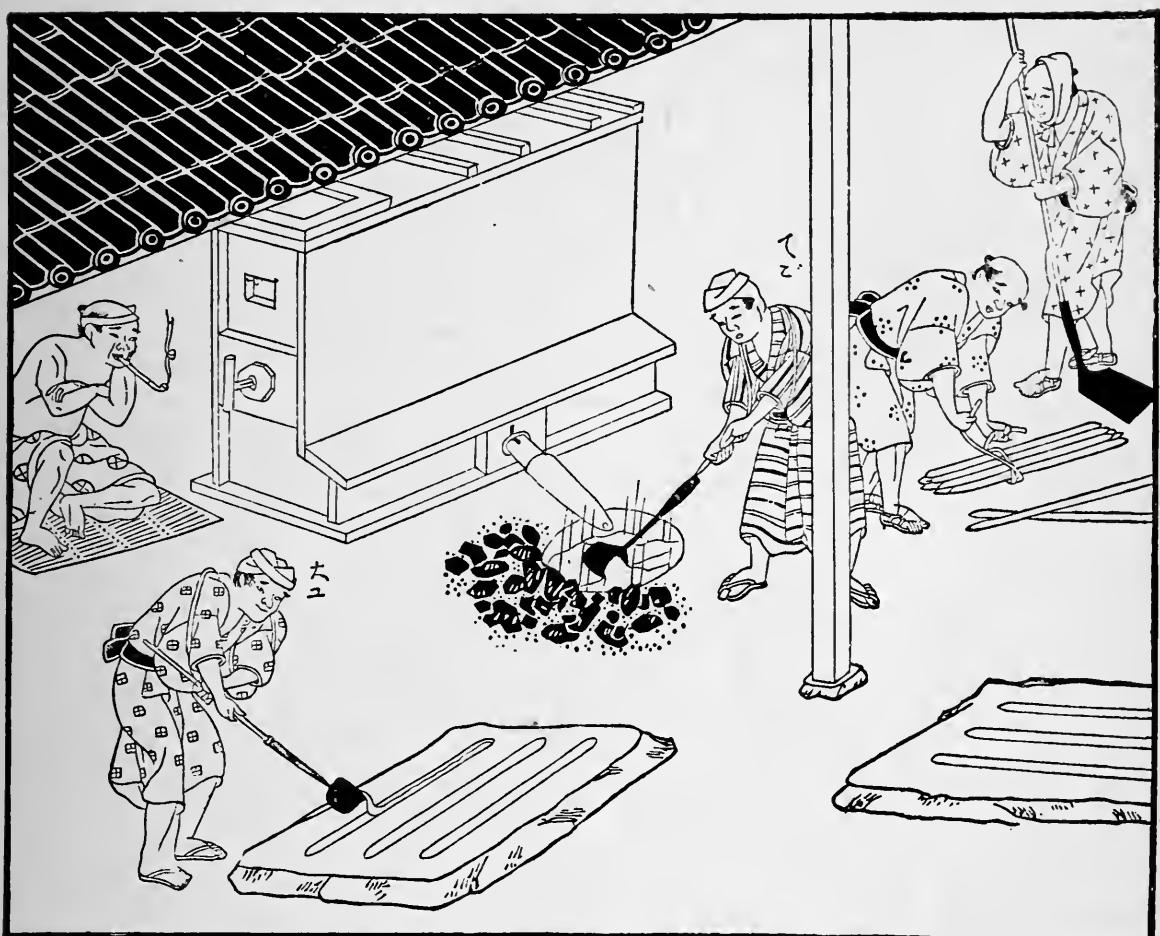


Fig. 6.—JAPANESE LEAD SMELTING (*Archæologia*, LVII.).

which I visited, where the ores were rather impure, no lead, but only silver, was obtained for sale.

All these mines, although true lead mines, were not regarded as such, but as silver mines, and were called *gin-san* (*gin*, silver; *san*, mine).

The lead obtained always contained silver in greater or less amounts, but the lead itself was to a great extent

sometimes entirely lost in the smelting and the subsequent process by which the more valuable metal was extracted.*

The silver was extracted from the argentiferous lead, obtained by a simple method of cupellation, which was conducted in precisely the same way as that followed by the nations of antiquity, and in similar furnaces.

I have examined the remains of these furnaces which have been dug up on the sites of Roman cities in this country, at Silchester and Wroxeter, and on a British site at Hengistbury Head. They are practically identical with the old Japanese furnace except that the material used in their construction was bone ash and not wood ash.

The furnace consisted simply of a shallow cavity in a layer of wood ashes—bone ash being used by the Romans—partially enclosed by stone or clay slabs in such a manner that a small chamber was formed around and above it. A charcoal fire was made in the chamber, and the lead to be desilverized was placed on it and melted. When sufficient had accumulated in the furnace cavity the fire was raked off towards the sides ; a blast of air was then introduced, by which the lead was oxidized, the lead oxide formed being absorbed by the bone ash, and a cake of silver, which also contained any gold that had been present in the ores, was left in the cavity.

In fig. 7 is illustrated the operation of cupellation in progress as conducted in Japan.

The silver resulting from the process when the lead ores were pure contained but small quantities of impurities, and was regarded as pure by the Greeks and Romans, as it is by the Chinese at the present day.

The silver from impure ores was sometimes impure from the presence of copper, etc., and was then again cupelled with pure lead in another but similar furnace.

The Japanese were especially skilful in conducting this process, and seem to have had no difficulty in producing silver of considerable purity by its means.

I have very often assayed the silver thus obtained, and the

* From this cause lead was in very limited use in Japan until quite recent times. Pipes, sheets for roofs, etc., were always of copper, and the chief use of lead was for the preparation of the alloys—pewter and copper-tin-lead bronzes.

most impure Japanese specimen I have ever found contained 97·5 per cent., and the purest 99·7 per cent. silver. Its average composition deduced from the assays of 555 samples was 99·0 per cent. silver. Even in very ancient times, during the period



Fig. 7.—CUPELLATION OF ARGENTIFEROUS LEAD (*Archæologia*, LVII).

of the dolmen builders, the Japanese seem to have been skilled in the metallurgy of this metal, as the silver beads of that date contain but very small proportions of lead and copper.

In making silver objects, and also for the older coinages,

the metal was sometimes used in this pure form, but generally small quantities of copper were added, not for the purpose of debasing it, but to increase its hardness, and also in order to obtain castings free from vesicular cavities—a matter of some difficulty with pure silver. The composition of some silver coins, sword-mounts, etc., is given in the following table:

“OLD” SILVER COINS, SWORD-MOUNTS, ETC.

Description.	Silver. Per cent.	Gold. Per cent.	Copper with a little lead.	Analyst.
Silver coin <i>Nishu</i> , 1773 A.D....	97.81	0.13	2.06	Koga
„ „ <i>Nanryō</i> , 1764 A.D.	97.55	0.20	2.25	Dillon
„ „ <i>Kō-ichibu</i> , 1837 A.D.	99.15	0.22	0.63	„
„ „ <i>Akita Gimban</i> , 1854 A.D. ...	98.70	0.07	1.23	Gowland
„ „ <i>Nishu</i> , 1868 A.D....	84.76	0.04	15.20	Koga
Silver sword-mounts <i>Seppa</i> , eighteenth century ...	97.20	0.19	2.61	Gowland
Silver sword-mounts <i>Kojiri</i> , eighteenth century ...	95.90	0.25	3.85	„
Silver sword-mounts <i>Fuchi</i> , eighteenth century ...	94.50	0.53	4.97	„
Silver finger-ring, nineteenth century	65.60	0.23	34.17	„

Poor alloys are sometimes found, although never in silver work by good artists, and they may contain not more than 50 per cent. of silver, and occasionally very much less. But these are generally special alloys, bearing the generic name *shibuichi*, which are not used as, or considered to be, silver, but are employed by art-workers for producing special decorative effects of colour, owing to the beautiful grey patina which they may be made to assume.

In the old Mints the silver was melted in the furnace shown in fig. 8. It consists simply of a hemispherical cavity in the floor of the melting-room, lined with refractory clay. This was filled with ignited charcoal, upon which the cakes of silver were placed and covered with more charcoal. The bellows were started, and when the silver was completely melted, and the necessary amount of copper had been added,

the fire was raked off, the molten metal stirred well with a stick of pinewood, and laded with an iron ladle usually into canvas moulds set in water. It was never cast in ornamental forms, but always in small cakes or bars, which were fashioned solely with the hammer and chisel.

When bars of debased silver—*i.e.* silver containing large quantities of copper—were cast (a practice which unfortunately was not seldom followed in the old Mints, when the military rulers of the country were in need of money) a special mode of procedure was adopted. The silver was always poured into moulds which were set in troughs of hot water as shown in fig. 8;



Fig. 8.—FURNACE AND MOULDS USED IN MELTING AND CASTING SILVER.

the reason for this being that the alloy contained so much copper that if cast in the ordinary way the bars would be coated with a black layer of copper oxide, which was difficult to remove. By placing the moulds under water this oxidation was prevented, and castings with a clean metallic surface were obtained.

The castings were, however, of a coppery hue, and this required removal. They were therefore heated to redness and then plunged into plum vinegar containing common salt in

solution. After digestion in this for some hours, they were boiled in plum vinegar without salt, and were then washed with water and dried. By these operations the copper in the alloy was removed from the surface layers, and a coating of pure silver left. The castings sometimes contained only from 15 to 20 per cent. silver, yet when the above operations had been carefully carried out these low alloys have the appearance of pure silver. The operation of digestion, or boiling in plum vinegar, was also practised for all coins and other objects, even when they consisted of silver of considerable purity. No silver objects have been found in the simple tumuli, the earliest burial-mounds of the Japanese, but the burial-chambers of the Dolmen Period have yielded several specimens of silver work, all of which were designed either for personal ornament or the decoration of the sword.

In the Higo Dolmen, already mentioned, there were found, together with the gilded copper articles and iron swords, a silver cap—*kashira*—for one end of the grip of a small sword, and a band, or *fuchi*, for the other extremity. Two of the swords have each a ring forged at the end of the tang, which had originally been thickly plated with silver. But several centuries earlier the metal had been used for plating the bronze and copper penannular rings called *gin kwan*, and for silvering bronze mirrors.

Of somewhat later date—about the fifth century—are four swords which were taken from the Musashi Dolmen, two of which have been already described, and are illustrated in Plate II. They are all fitted with silver mounts, one having a silver *kashira*, and all being furnished with rings and broad bands of silver encircling the scabbard. Other specimens of the silver mounts of sword-scabbards of the same period have been found in other dolmens.

Also of the fifth century are hollow silver beads for a necklace, and finger-rings and armlets which I found in a dolmen at Rokuyamura, in the province of Kawachi, together with the curved stone ornaments—*magatama*—and long cylindrical beads—*kudatama*.

The earliest specimen of large silver objects known to me is a silver bowl (Plate V), of the Nara Period, now in the treasury of the temple Tōdaiji (Nara). It is seventeen inches

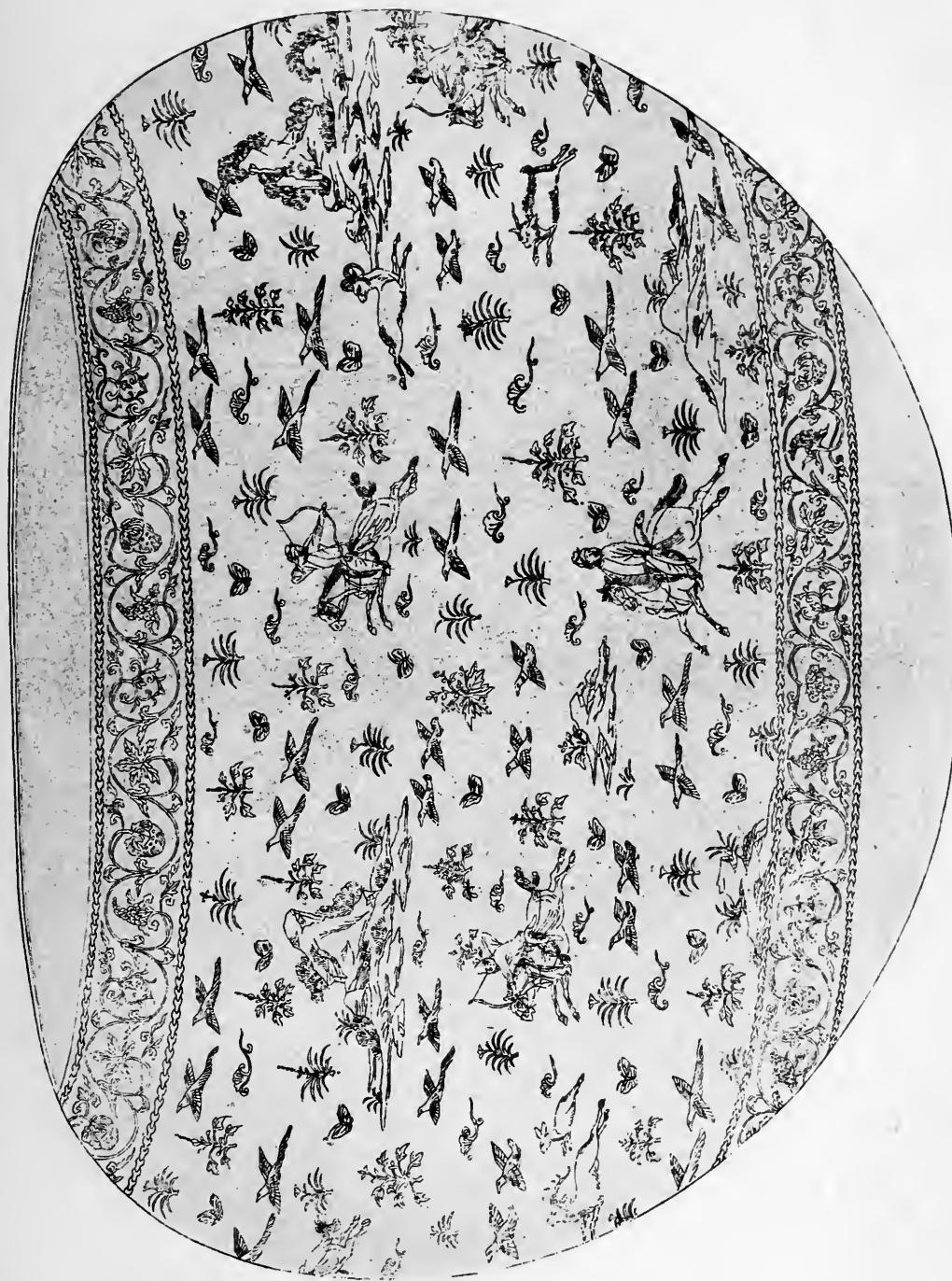
銀壺

高厚

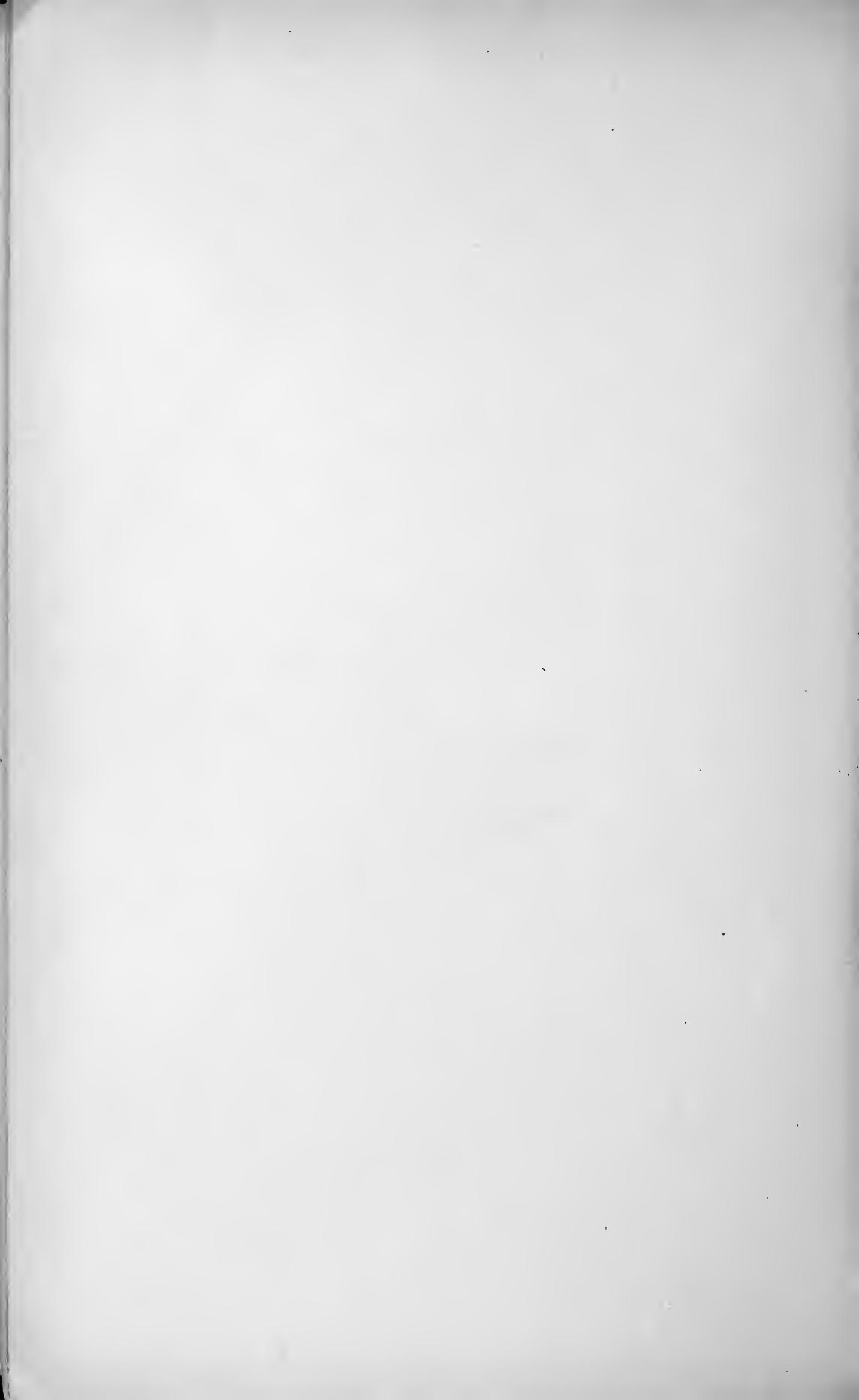
一尺四寸圓徑
一分二釐縮圖

一尺四分口徑
二分之一

一尺三寸九分



SILVER VESSEL WITH ENGRAVED DESIGNS.



in height, and the date 767 A.D. is ascribed to it. The various scenes from the hunting-field, which are portrayed on the bowl in incised lines, afford an excellent example of the combined naturalistic and conventionalized representations of natural objects usually seen in early Chinese decorative art.

From that time until late in the Middle Ages objects of silver are not at all common. The cold and sober colour of the metal unfitted it for the display made at Buddhist temples and ceremonies, while it was used but seldom for their chief vessels and utensils. Silver plate in our sense of the term was never in use, even in the palaces of the nobles, or, if so, none has come down to us.

So that up to near the beginning of the seventeenth century specimens of a few coinages and a few sword-mounts are almost the only examples of its use which are in existence. The impetus which was then given to the decorative arts by the cessation of the civil wars resulted in a marked extension of the employment of silver during succeeding centuries, especially in the form of its alloys with copper, for guards and other sword furniture. And in the eighteenth, but more particularly during last, century, numerous objects rarely made of the metal heretofore, such as kettles, vases, and ornaments, have been produced by several noted craftsmen, and not a few of these are masterpieces of chasing and repoussé work, in no way inferior, either in beauty of design or delicacy of execution, to the best art-work of earlier times.

IRON.

The metal iron, according to the old Chinese philosophers, is a product of the masculine principle of Nature, and therefore possesses hardness and tenacity.

In Western Asia especially, and also in India and China, iron was in use many centuries prior to its use in Japan.

Iron ores are of common occurrence in China, chiefly in the Western provinces, but there is no concrete evidence to show how early they were worked for the metal.

As to the time of the first use of iron in that country, the evidence, too, afforded by the ancient literature is of a very doubtful character. In the *Shu-King*, to which the date 2000 B.C. has been attributed, iron is indeed mentioned, but

with this exception there is no allusion to iron in writings older than about 1000 B.C. (Edkins).

The magnetic compass, however, is said to have been invented by the Chinese at a very remote date, earlier than 1000 B.C., and if so they must then have been acquainted with steel.

The Japanese, when they migrated from the mainland, were passing out of the Bronze Age stage of culture and entering the Iron Age, as I have already stated, and they had become skilful workers in iron when they became dolmen builders, three or four centuries B.C. No weapons except iron swords, spear-heads, and arrow-heads have been found in the chambers of the dolmens, and all, more particularly the swords, are splendid examples of the work of the smith.

Traditional records point to Korea as the source from which iron was first obtained, but the abundant occurrence in Japan of an iron ore easily reducible in the most primitive furnaces must have resulted in its production in the country itself at a very early date.

In this connection I may state that there is no simpler or easier process than the production of malleable iron from its ores in a charcoal fire. No fusion is required in the case of iron, as in that of copper: the metal is obtained as an unfused lump, which only needs hammering to fashion it into weapons or implements. The erroneous belief which is still too prevalent among archaeologists, even at the present day, that fusion is necessary for the extraction of iron, is evidently founded on the modern method of iron-smelting, by which cast-iron is first produced, and subsequently converted by special processes into malleable iron or steel—this in spite of the fact that this method only dates from the fifteenth century.

I hence hold that the metal must have been obtained by smelting the ores existing in the country, certainly before the beginning of our era.

No elaborate appliances or tools were needed for the operations. Even at the present day, in Ceylon, the bloom or mass of iron is taken out of the furnace with long tongs made of green wood sticks tied together at one end, and is then beaten a little into shape with thick sticks. In Africa the stem of a creeper is employed for the same purpose, and the bloom is

then hammered into shape with a stone, a larger stone serving as an anvil.

In Japan the iron-smelting furnace which still survives in some districts, and in which, until about fifty years ago, the whole of the iron and steel needed in the country was produced, has no parallel in its simplicity, rudeness, and temporary character. Even the earliest furnaces of Europe, so far as we

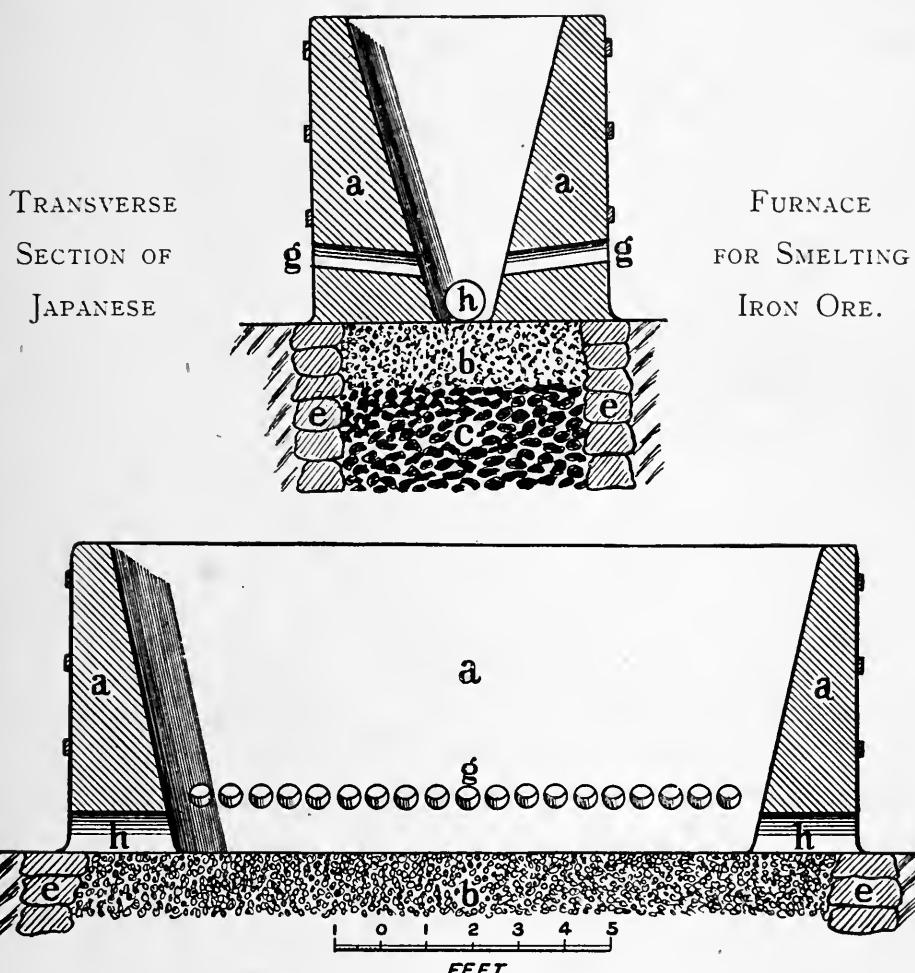


Fig. 9.—LONGITUDINAL SECTION.

can infer from their vestiges which have been unearthed, were of a more advanced type. It consists simply of a V-shaped trough of common clay, with holes near the bottom for the introduction of the blast (figs. 9 *above*).^{*} The furnace is charged with alternate layers of charcoal and ore during

* Gowland, *Early Metallurgy* ("Archæologia," Vol. LVI. p. 306, figs. 19 and 20).

about fifty or sixty hours, after which the sides are so much fused and corroded that the operation is stopped, the end walls are broken down, and the fire raked out. Masses of wrought iron and steel are then seen to be adhering to the side walls. These are removed by levers and bars and broken up when cold. A new furnace is at once constructed on the old site, and is ready for work in about twenty-four hours.

This smelting process, notwithstanding its primitive character and the rudeness of the furnace and appliances, was capable of performing excellent work. It produced without difficulty an iron purer by far than our huge furnaces and complicated appliances can yield, and it furnished the steel for the famous swords of old Japan.

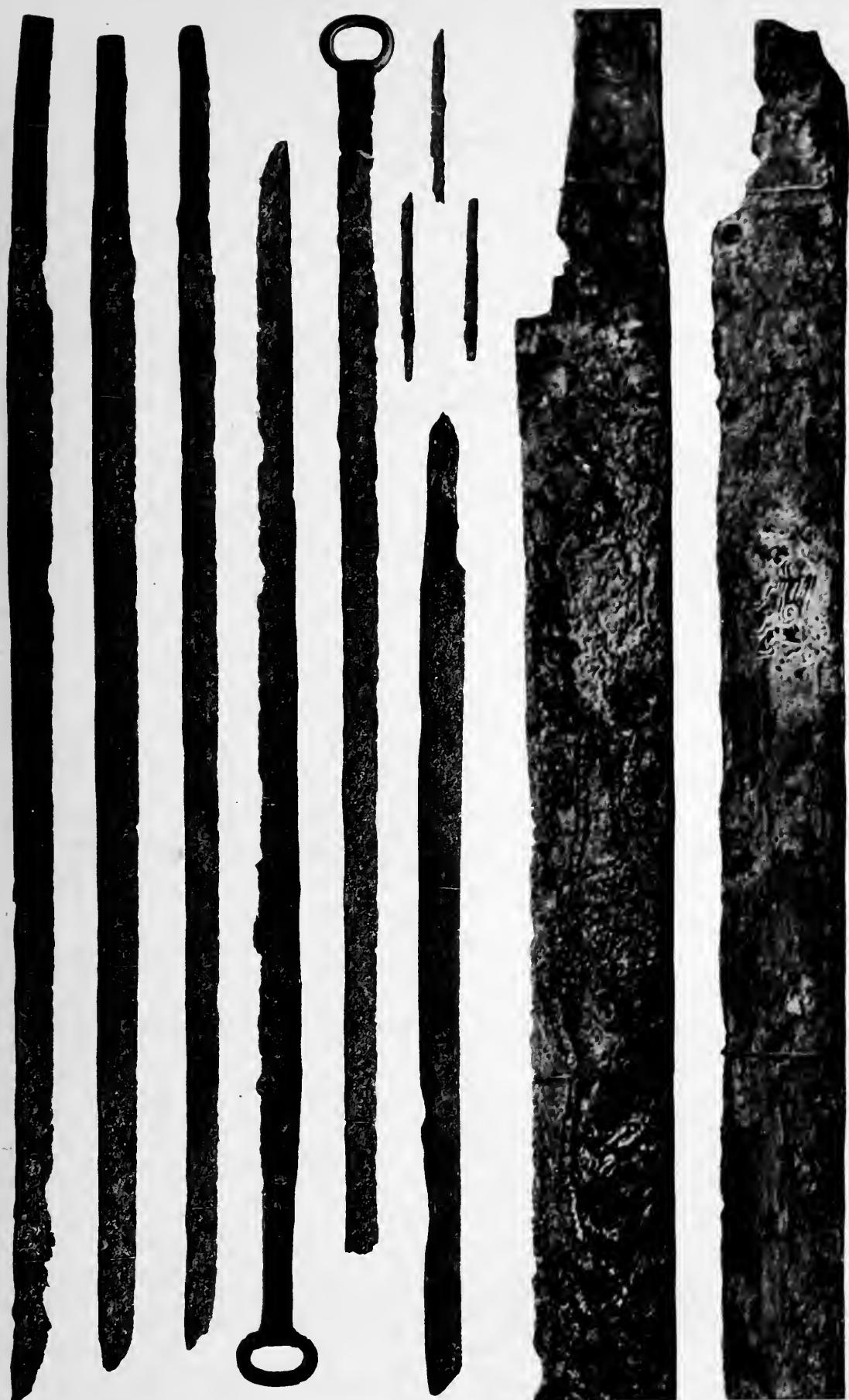
Among all objects of iron and steel in Western countries in early times, a foremost place must be given to the weapon which has lived through all time, the warrior's sword. In Japan, even more than in the West, the sword has ever occupied a specially pre-eminent position of honour and renown. It is regarded as being of Divine origin, and is spoken of as the "soul of the warrior." On it, for more than eighteen centuries, the highest skill has been lavished to make it not only perfect as a weapon for the stern needs of war, but also perfect as a work of art to adorn the person in times of peace. Amongst the most important objects in the remains which the burial-chambers of the ancient dolmens have yielded, iron swords occupy a prominent position.

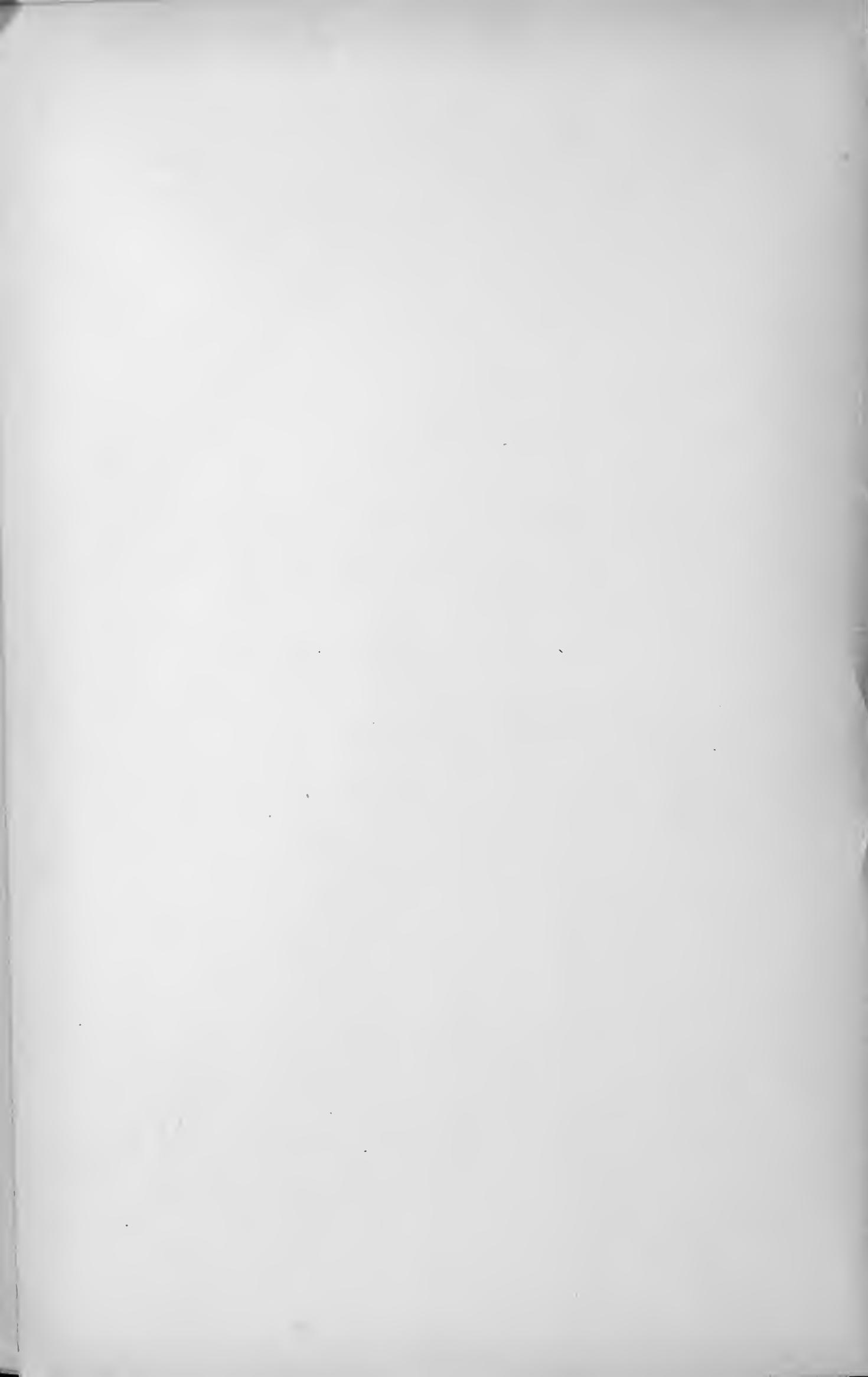
It would be natural to expect that the transition from bronze to iron weapons would be gradual, and that both would, for some time at least, be in contemporaneous use, yet there is not a single instance in which both have been found together, with the rare exception of arrow-heads.

It is also important to note that the shape of the iron weapons is entirely distinct from those of bronze, and that no intermediate forms are known.

The swords of the Dolmen Period have one special characteristic—*i.e.* they have a perfectly straight back, and are thus quite distinct from those of later times, all of which have a slight curvature. It is, in fact, essentially the sword of that period, first appearing at its beginning, and dying out and being replaced by the curved sword at its close. These swords

SWORDS OF THE DOLMEN PERIOD. (Joly and Inada, *The Sword and Samō*, 1913. Gowland, photo.)





are of two kinds, long and short. I have examined ninety-two of them. The former are the more numerous, and the length of their blades from guard to point, of those which were sufficiently perfect for measurement, ranges from 2 ft. 6 in. to 3 ft. Typical specimens of blades are shown in Plate VI.* The short swords vary from 1 ft. 8 in. to 2 ft. A few daggers have been found, their shapes being derived from the iron, and not from the bronze weapons.

Of equal importance with the swords are the specimens of iron armour, which have been found more or less complete. Owing to its thinness, and hence liability to be destroyed by rusting, only a few tolerably perfect examples of the armour of the period have survived. But in several dolmens I have examined, in which no armour could be recognized, there were considerable shapeless agglomerations of iron rust, in which the forms of even more massive objects could not be made out, and which may have been derived from armour.

Fragments of metal-work of the hilts and scabbards occur with the swords in most dolmens, but they are usually so much broken up and imperfect that until the discovery of the two swords (already alluded to) it was in many cases impossible to determine what their uses had been.

The guards, or *tsuba*, of these swords, which were generally of iron, but sometimes of copper, differed like the swords from those of post-dolmen times.

In Plate VIII.† are represented some pieces of armour and a helmet, which I have already partially described in a previous communication to the Society.

They were found in the dolmen in the province of Higo together with the swords described above.

Two forms of construction appear to have been followed. The cuirass on the right, and the helmet, consist of thin

* From Joly and Inada, *The Sword and Samé*. (From photos by Prof. Gowland.)

Gowland, *The Dolmens of Japan and their Builders* ("Trans. and Proc. Japan Society," Vol. IV. Plate X. fig. 1). See also *The Dolmens and Burial-mounds in Japan* ("Archæologia," Vol. LV. p. 485, fig. 26).

† Gowland, *The Dolmens of Japan and their Builders* ("Trans. and Proc. Japan Society," Vol. IV. Plate XI.).

plates of iron riveted together with iron rivets ; whilst in the cuirass on the left, the back of which only has survived, the plates have been fastened together with thongs or cords. Both the cuirasses differ entirely in form and construction from those of historical times, but they agree very closely with the armour represented on the terra-cotta figures (*tsuchi-ningyo*) which, about the beginning of our era, were set up around the summits of the tumuli of emperors and important personages in the place of the living retainers who, previous to that time, had been buried alive in the same position. An illustration of one of these figures from a tumulus at Nakojo, Musashi, is given in Plate VII.*

Other ancient objects of iron are the bits and trappings of the horse of the warrior, which were interred with him along with his weapons and armour. They have been already described above.

Iron spear-heads have also been found in the dolmens, but they are of much less common occurrence than swords. They do not differ greatly from those of mediæval and later times.

Iron arrow-heads are of extensive occurrence, and have been found in dolmens of every group which had not been rifled of their contents in bygone times. Arrow-heads, to



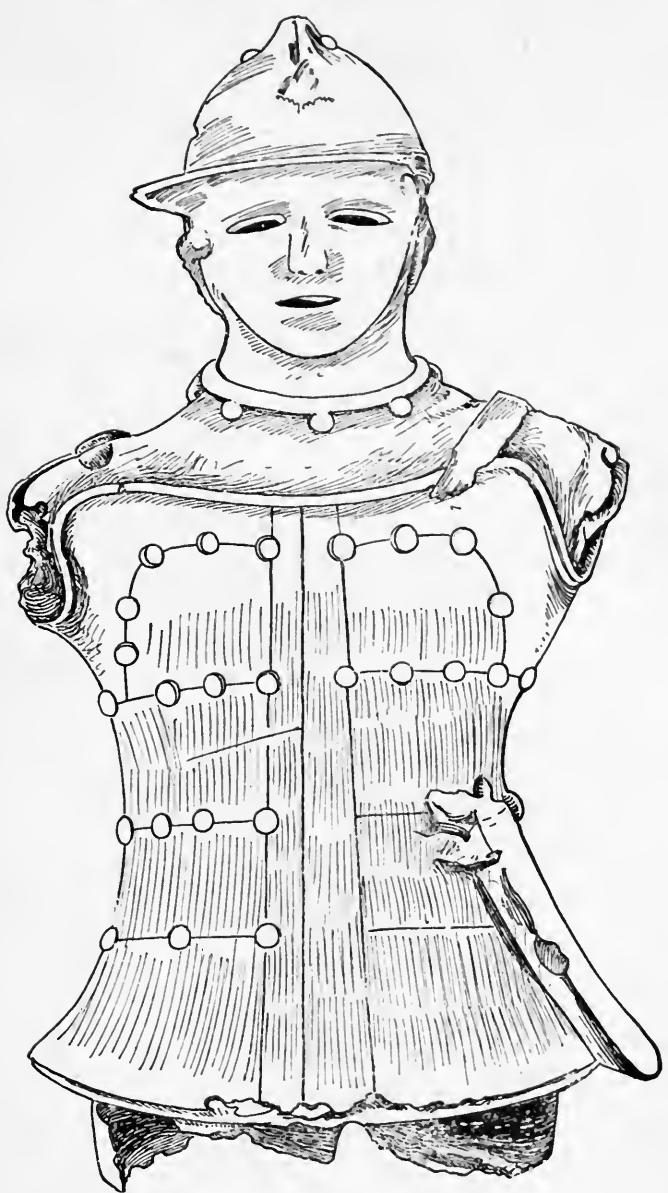
ARROW-HEAD.

which the date third century has been ascribed, are now in the possession of the temple Tōdaiji. The forms of some have been derived from the more ancient arrow-heads of bronze (Plate IX.), but generally they are entirely different, and are of decided iron form. By far the greater number of those I have found are of the form shown in fig. 10.†

The length of those that are but little attacked by rust, is about $6\frac{1}{2}$ in., the stem and head projecting about four inches beyond the shaft. A considerable number of single-barbed one-sided heads, resembling the above form cut in half lengthwise, I have found in dolmens in the province of Kawachi.

* Gowland, *Dolmens and Burial-mounds in Japan* ("Archæologia," Vol. LV. p. 501, fig. 41).

† *Ibid.* p. 485, fig. 27.

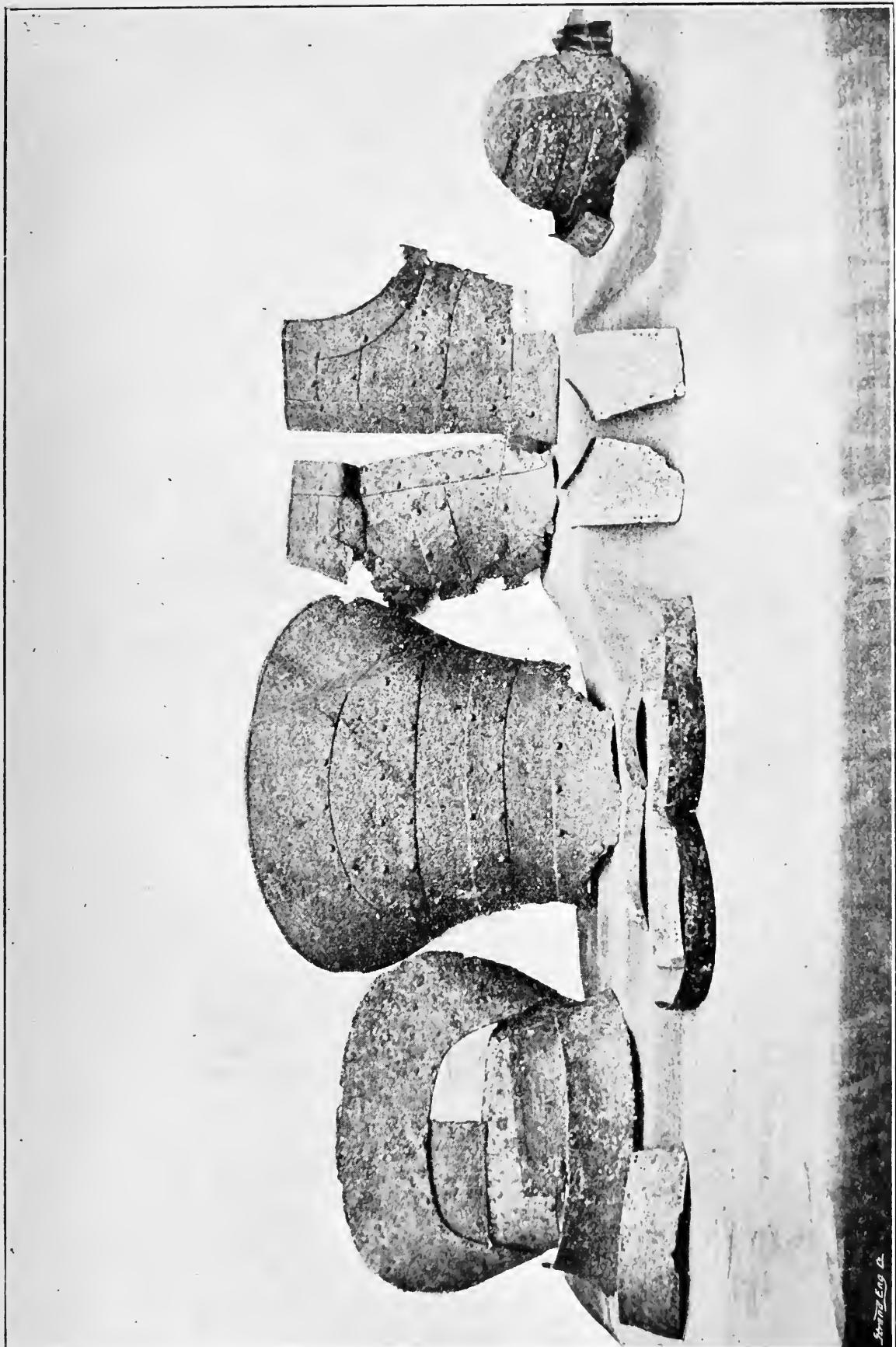


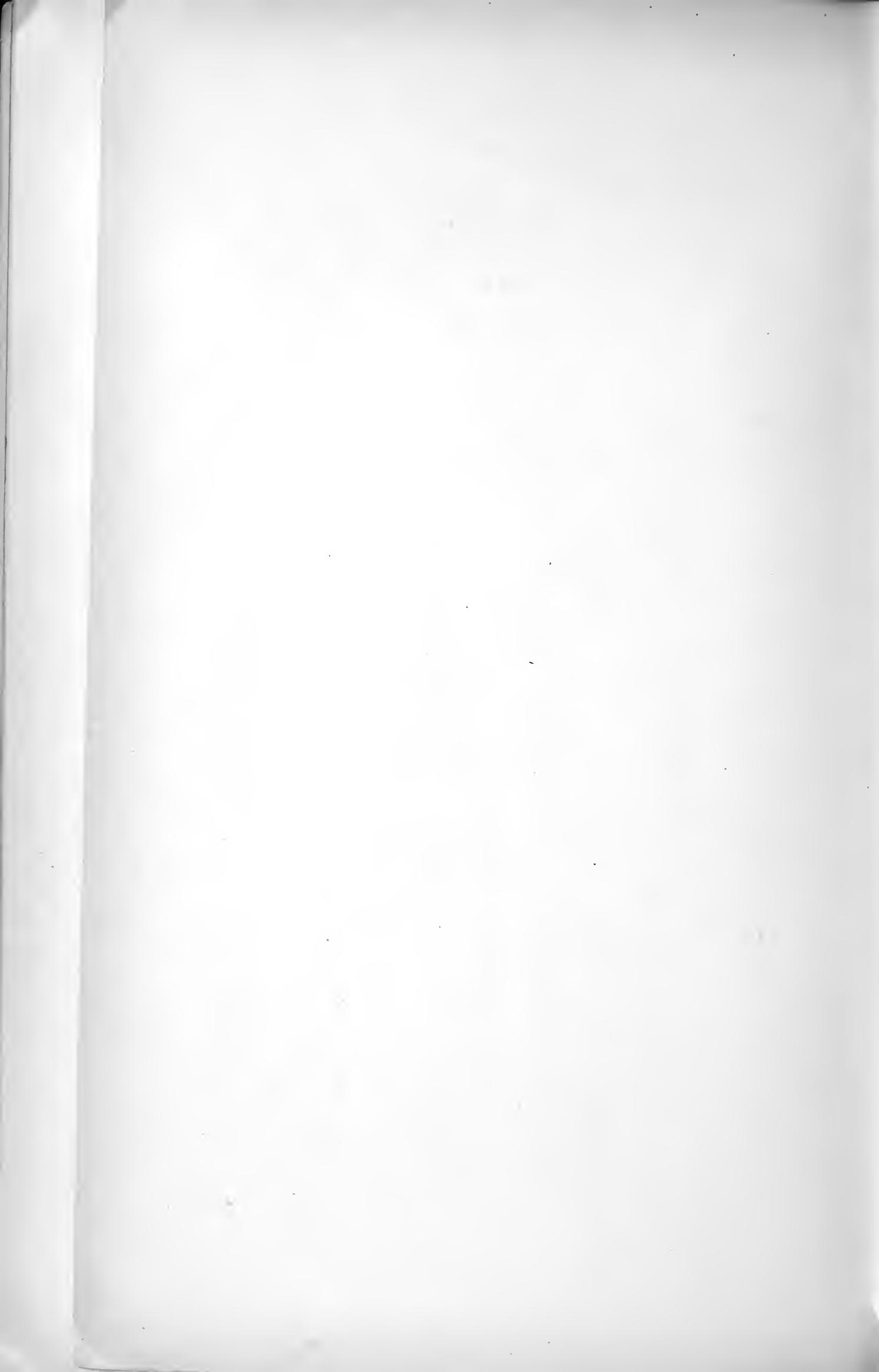
TSUCHI NINGYO.



ARMOUR AND HELMET FROM THE HIGO DOLMEN.

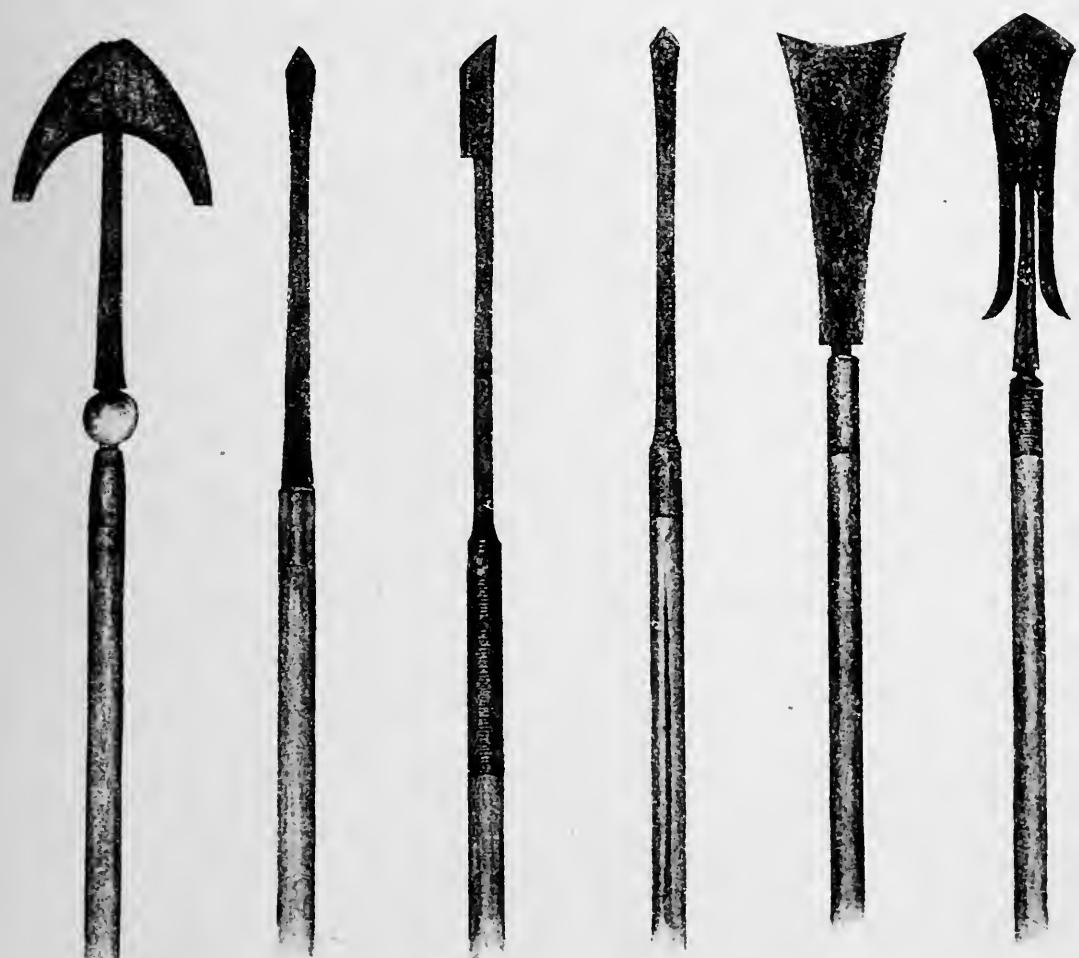
Archaeology







TERRA COTTA HORSE HEAD.



ARROW HEADS.



But few stirrup-irons (fig. 10)* have survived : only two pairs are known to me. They resemble European forms, but are entirely different from those of later times in Japan.

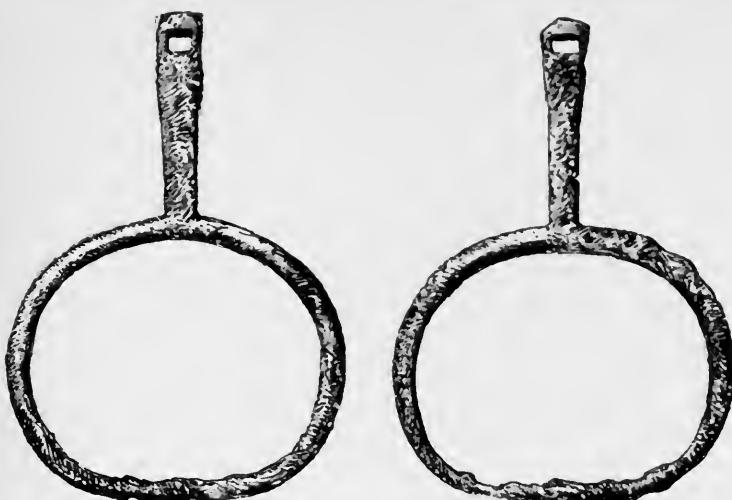


Fig. 10.—STIRRUPS.

The subject of later swords extends over such a very wide field that a special and long paper would be required for its adequate treatment. I will therefore mention only the earliest swords known to me of post-dolmen date.

Here I may say, around no craftsman in Japan has mythical legend or ancient story thrown such a halo as around the smith. In a remote antiquity his ancestors are numbered among the gods of the Divine Age, and in later times his astounding feats form the themes of innumerable tales. His profession, notwithstanding the manual labour it involved, was deemed an honourable one, and men of gentle birth were not debarred from pursuing it.

Shortly after the time when burial in dolmens was being given up, towards the end of the reign of the Emperor Mommu in the Daiho Period, 701 to 713 A.D., there arose in the province of Yamato a famous smith, Amakuni, the first sword-maker who is not a mythical or semi-legendary person. Two specimens of his work are preserved in the temple at Itsukushima. They are the first of the curved blades in existence.

Other important examples of wrought-iron work are the helmets, the breastplates of the corselet, and the various smaller plates of the armour of mediæval times.

* Gowland, *Dolmens and Burial-mounds in Japan* ("Archæologia," Vol. LV. p. 489, fig. 32).

As regards the helmets it will suffice to say that their construction differed from those of the Dolmen Period in the plates being gores, riveted together vertically, instead of broad bands riveted horizontally.

The breastplates of the corselet of the best period are especially magnificent examples of the work of the smith, in repoussé work, generally in high relief.

Although the armourer was a smith, yet his craft was entirely distinct from that of the sword-maker.* Between both craftsmen there was an intense emulous rivalry, and it is but rarely that we find either entrenching on the work of the other. Wonderfully dexterous as a smith in forging iron into thin plates of delicate forms and contour, the armourer was, besides especially in later times, no less skilful as an artist in, decorating them with rich and varied ornament. In early days his fame was measured by the resistance which his masterpieces offered to the trenchant blades of his rival, the sword-smith. In later times he was chiefly renowned for the beauty of the designs with which they were adorned.

Both wrought-iron and steel—the latter less frequently—were used in making the plates of which the helmet and body armour were constructed. All were forged from carefully selected pieces of metal, but the extraordinary toughness which many are found to possess is due to the repeated doubling and welding to which the iron was subjected before it was finally hammered into the required shapes.

One family, the Miochin, stands out pre-eminently as unsurpassed, and even unequalled, as armourers. Its very name commemorates the fame of one of its early members, Munesuke (in the twelfth century), in recognition of his skill.

From that day, for more than six centuries, members of the family occupied with distinction the proud position of Government armourers, and worthily sustained the repute of their ancestor.

Every genuine piece of hammered ironwork by a Miochin, whether plain or ornamental, is a perfect specimen of the handicraft of the smith.

According to the "Records of the Miochin Family" (*Miochin Rekidai Zokufu*), a long line of armourers, from whom

* They were called *Katsushi* and *Katana Kaji* respectively.—[Ed.]

田村 將軍 肖像



TAMURA SHOGUN, dated Konin II., after Shōjō Kyōsai.



the first Miochin was descended, is traced back to the Divine Age. Setting aside, however, the mythical traditions relating to the early members of the family, we have less doubtful accounts of the Masuda, who are said to have been famous armourers from the ninth to the twelfth century. Some of the helmets and armour made by them are described, but so far I have not been able to find any authentic specimens of their work.

The ancient iron sword-guard, with its pierced trapezoidal apertures, has already been considered. From the twelfth to the fourteenth century the iron guard is still without ornament, except simple geometric perforations.

From the sixteenth century onwards, this simple ornament gave place to intricate pierced patterns and richly engraved and inlaid designs. Many of these iron guards, especially of the seventeenth and eighteenth centuries, are marvels of skill and patient work. Forms of the greatest delicacy, often almost microscopic in their details, others with bold contours and sweeping curves worthy of the artist's brush, are alike carved with as much accuracy and freedom as if the material was plastic clay rather than solid iron.

In some, the pierced cuts are so fine that they do not exceed $\frac{1}{250}$ of an inch in width, and their sides are perfectly parallel. These were produced by a very laborious method of procedure. A minute hole was first drilled in the iron with a fine steel wire moistened with oil and powdered garnets or siliceous rock ; the hole was then elongated into a slit by means of another fine steel wire used as a saw, also moistened with oil and the above powder. These cuts were further continued with flat wires, and were then reduced to the extreme degree of fineness required by hammering both sides of the metal until they were sufficiently closed. The sides of the cuts were kept parallel by rubbing them from time to time with flat wires of steel and grinding-powder. Iron guards by the best craftsmen were never cast ; they were always of wrought iron.

A very notable example of work in hammered iron is the celebrated eagle in the Victoria and Albert Museum, illustrated in Plate XI. It has been attributed to the sixteenth or beginning of the seventeenth century, and is said to be the work of one of the Miochin family. Whether this attribution is correct

or not, it is certainly one of the most admirable works in wrought-iron which has been executed in Japan or in any other country. Its wings extend 4 ft. $4\frac{1}{2}$ in. from tip to tip.

The largest forgings of the smith were for industrial purposes, and it may interest you to see an illustration (fig. 11) showing the manner in which they were conducted when cranes and other similar mechanical appliances were unknown.

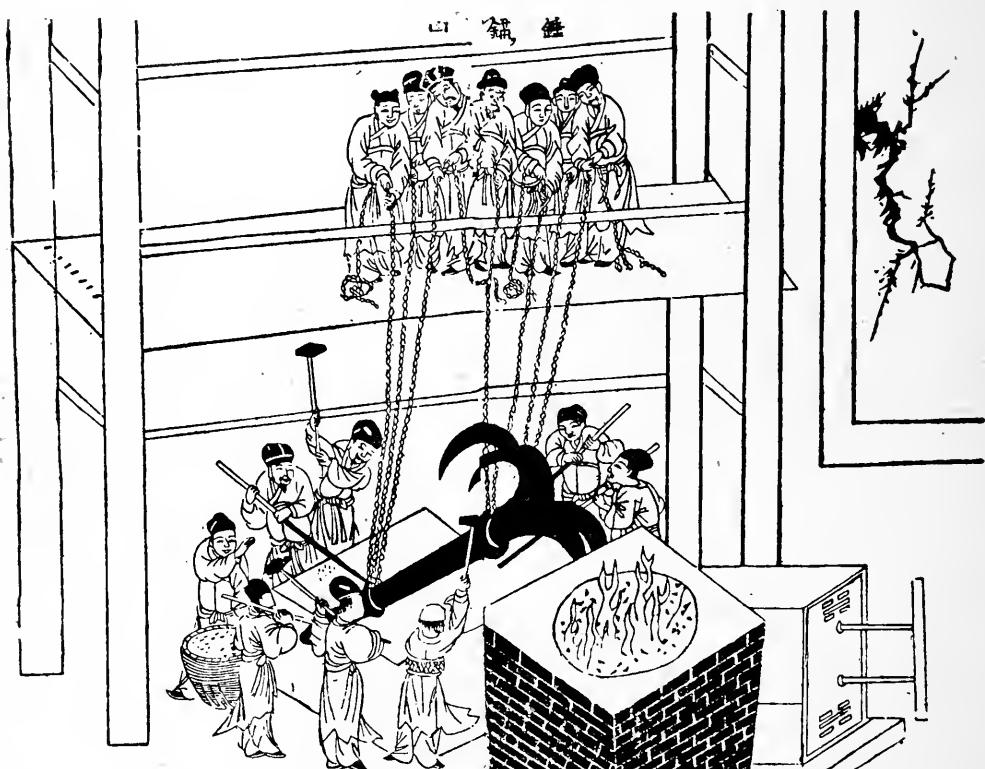


Fig. 11.—CHINESE SMITHS FORGING AN ANCHOR.

It represents the forgings of a ship's anchor in the sixteenth century, taken from an old Chinese metallurgical treatise published in 1636 A.D.

The heavy mass was suspended by chains, which were held by eight men stationed in a gallery, who moved it about on the anvil as required by the smiths.

CAST-IRON.

Cast-iron does not appear to have been known to the Japanese in prehistoric times; it is, however, recorded that in the year 700 A.D. a regulation was made restricting to the Government the coinage of cast-iron coins, a date much earlier than its use in Europe.



WROUGHT IRON EAGLE (Victoria and Albert Museum, London).

The last issue of these iron coins was made some years ago ; and although they are not in circulation as legal currency, they are still extensively used for contributions to offertories and collections at religious services. I may add that two thousand can be bought for sixpence, so that donations may be made by the most parsimonious.

Two standard lanterns (*toro*) at Nikkō are the only large art objects of cast-iron known to me. They were presented to the shrine in 1641 by Date Masamune, lord of Sendai.

The metal has been chiefly employed by the art craftsman in small castings, such as kettles and other vessels for heating water or wine, and many of these are masterpieces of modelling and decoration. They are cast by the method of *cera perduta*, a process which will be described when dealing with the casting of bronze. When these castings are taken from the moulds in which they have been cast, although they may be perfect so far as the ornamental designs, which had been modelled in wax, are concerned, yet they are quite unfit for further decoration by either chasing, inlaying, or similar processes. Their surfaces are hard and brittle ; they are hence subjected to the following softening and decarburizing process :

The furnace used in the process consists of a cast-iron pan, from which the bottom has been broken away, with a lining of refractory clay. This is placed on a fireclay slab, which is perforated with numerous holes. The whole is set upon three or four bricks on the floor of the workshop. The cast-iron object is placed inside the furnace so that it rests directly on the perforated slab, and the space between it and the sides is filled with charcoal in carefully broken lumps. The charcoal is ignited and allowed to burn for an hour or more ; and when nearly all is consumed the object is reversed, and the operation repeated. The surface of the casting is then found to be soft and malleable, the finest lines and channels can be chiselled in it with unbroken edges, and any mode of surface decoration can be conducted without difficulty.

After the object has been decorated, the fine brown oxidized surface to which these castings owe so much of their beauty, and by which the effect of their ornamental designs is so much heightened, has yet to be produced. For costly objects, the whole surface is carefully gone over with a pointed punch to

give it the irregularly rough texture which is so much esteemed by the Japanese. The casting is then heated over a small charcoal fire, and as soon as a portion of it has reached the proper temperature it is rubbed with a liquid consisting of plum vinegar containing iron in solution and ferric oxide in suspension. Another part is similarly heated and rubbed until the entire surface has been treated, and the desired amount of rusting has been produced. After being well rubbed with a dry cloth, it is covered with a thin coat of lacquer and heated cautiously over a brazier, a fine spray of water being splashed on it with a brush during the operation.

A typical specimen of one of these cast-iron kettles, with a punched surface and gold and silver inlays and *azziminia* work, is shown in Plate XVI.

COPPER.

Copper and its alloys.—Copper, or, as it is called by the Japanese, *akagane*, the “red metal,” is the metal *par excellence* of Japan, as, in addition to its extensive use as a constituent of bronze, its applications are more numerous than in any other country, and many are unique.

According to the old Chinese teachings its origin is similar to that of gold or silver. By the action of a violent sun a green earth is generated, which in the space of two centuries becomes a stone, and this when acted on by the masculine principle of Nature during a further period of time is changed into a mineral yielding copper. Copper being a product of the masculine principle of Nature, it is hence tenacious and hard. No objects of copper or fragments of the metal have been found along with the earliest bronze weapons of prehistoric times, and there is no evidence whatever, not even that of tradition, of a Copper Age in Japan; but in the early centuries of our era the Japanese had acquired a skill in the preparation and working of copper far in advance of that attained by any race until many centuries after the beginning of the Iron Age or even in Roman times.

In China, archæological exploration has been of a very limited character, as the examination of ancient burial-sites is not only prohibited by the Government, but is strongly opposed by the people. Hence we know practically nothing from actual finds of the Early Bronze Age culture of that ancient people.



COPPER SMELTING IN OLD JAPAN.

Copper ores occur in many places, but it is impossible to assign an even approximate date to the earliest workings, as they have not yet been systematically examined. If, however, we accept the date 2205 B.C. given in Chinese annals for the casting of the nine bronze tripod cauldrons often mentioned in historical records, then the metal copper may have been in use as early as 3000 B.C., or even earlier.

It was first employed in the form of metallic copper near the beginning of our era, as we have already seen, by the builders of the dolmens and chambered tumuli, who made use of it chiefly in thin plates coated with gold for the decoration of the sword and person of the warrior, and for coating the ornamental iron appendages of the trappings and the cheek-pieces of the bits of his horse.

The use of thin sheets of copper coated with gold for protecting and decorating iron died out with the dolmen period, but their use for covering and ornamenting surfaces of wood survived to the present day. The art of decorating by means of sheets of copper coated with gold reached a high point of excellence during the Nara Period, and, in addition to the old methods of repoussé and punched work, perforated designs were then introduced. It was chiefly applied in the ornamentation of shrines and ceremonial utensils of the Buddhist religion.

The method of smelting copper ores, practised by the Japanese up to our own times, is of special interest, as it is a survival of that followed by prehistoric man in the Bronze Age.

Here I may point out that the extraction of the common metals from their ores does not require the elaborate furnaces and complicated processes of our own days, as pieces of ore, either copper carbonate or oxide, cassiterite, cerusite, or mixtures of these, and even iron oxides which by chance formed part of the ring of stones enclosing the domestic fire and which became accidentally embedded in its embers, would become reduced to metal. The prehistoric camp-fire was, in fact, the first metallurgical furnace, and from it, by successive modifications, the huge furnaces of the present day have been gradually evolved. First, a shallow cavity would be formed in the hearth of the fire for the reception of the molten metal,

and this would be made larger as time went on and larger quantities of metal were required.

No appliance of primitive metallurgy could be simpler, either in shape or construction, than the Japanese furnace, figured on p. 57.* It consists merely of a hole in the ground ; yet by means of it all the copper, lead, and tin required in the country was obtained. As late as 1884 it was practically in universal use, and in that year 8,816 tons of copper were produced by its means. They still are in use to a considerable extent, more particularly at small mines and in remote districts, although at the larger mines all the furnaces and appliances of modern metallurgy have been everywhere adopted.

In the old days, before the art of mining was known, the ores which were smelted for copper were surface ores, those which occurred in the upper parts of mineral veins. These ores consisted of oxidized compounds of copper, and were easily reducible to metal. Hence the operation of smelting was of the simplest character (Plates XII. and XIII.). A blast of air was supplied to the furnace through the pipes shown in Plate XIII., by one or two bellows placed behind it. A small fire was made in the furnace, and alternate layers of ore and charcoal were charged in until they formed a small conical heap above it. The blast was urged until the charge was melted, when the earthy matter of the ore was converted into slag, the metallic copper sinking below it to the bottom of the furnace.

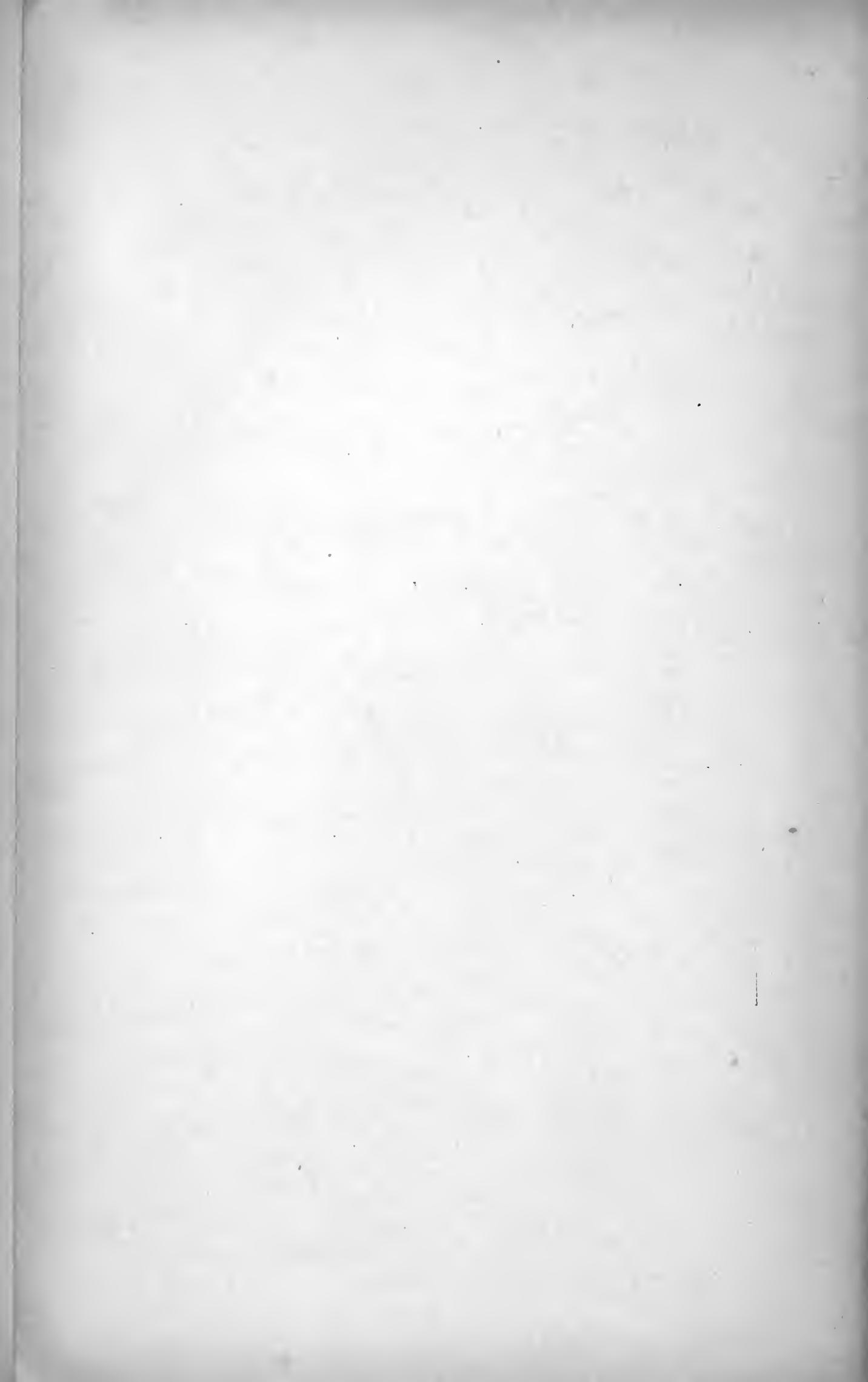
In later times, after mining was practised, and the deeper parts of the veins were exploited, the ores changed in character, becoming sulphide ores, which were first burnt in heaps before being smelted as above. The product, too, was not metallic copper, but a sulphide, which was converted into metal by directing the blast upon its surface.

These simple furnaces are by no means to be despised. They are so eminently adapted for the use of mining prospectors at the present day, and for the first development of an ore body, that I have long recommended their use to any who may be engaged in the search for or opening up of mineral veins. (I think it will be admitted by all that when a prospector has been fortunate in discovering a mineral deposit, if he can send home with his report a few ingots of copper,

* *Archæologia*, Vol. LVI. p. 277, fig. 5.



REMOVING THE COPPER FROM THE SMELTING FURNACE.



pigs of lead, or a few bars of silver, the report will be of greater value, and carry more weight at a directors' meeting, than if it had not been thus accompanied.) Then, as regards the first development of a mine, these simple furnaces are of special importance, as by their means he can begin smelting operations and be producing metal at once, and thus gain an insight into the character of the ore, which will be of the

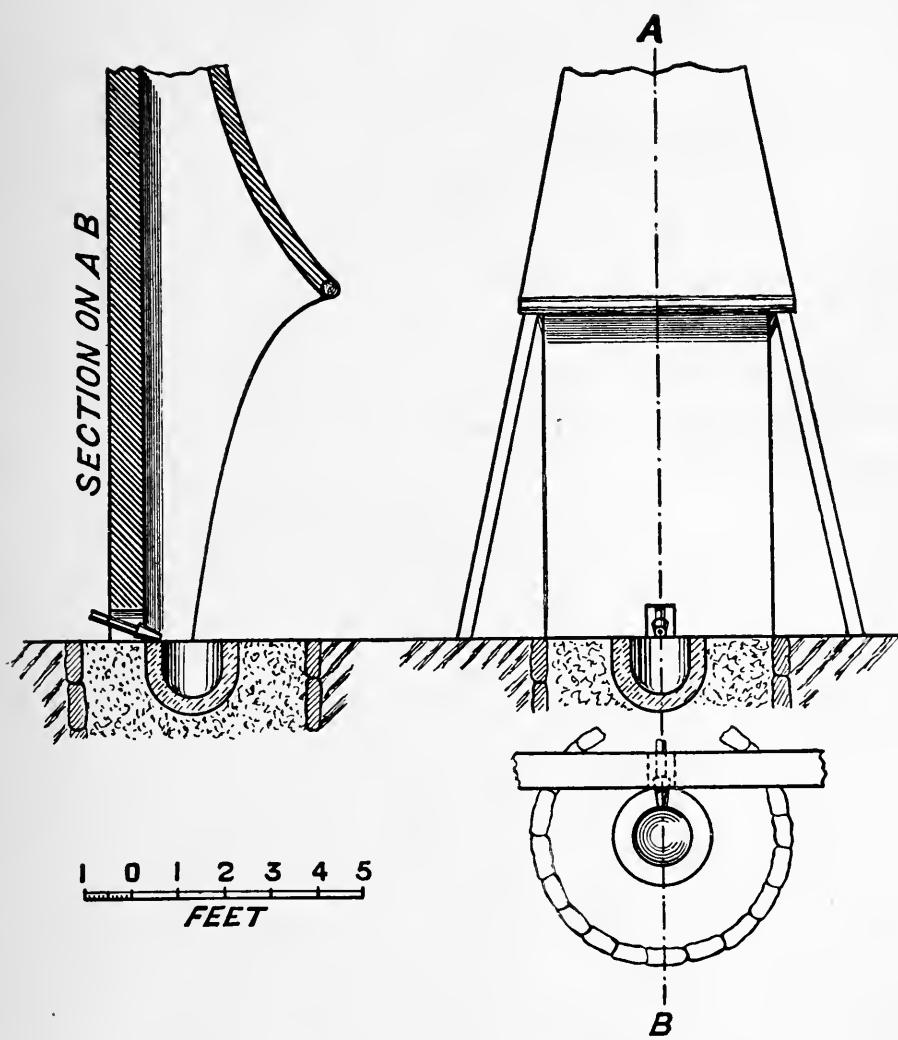


Fig. 12.—JAPANESE FURNACE FOR SMELTING COPPER.

greatest assistance when he has to decide on the process by which the metal can be most economically extracted, and the plant which will be most efficient for the purpose.

Copper has not, to my knowledge, been found along with the bronze weapons of the pre-Dolmen Period, and, as I have stated above, there is no evidence whatever of a Copper Age in Japan.

Its earliest use in the form of metallic copper dates from the Dolmen Period, two or three centuries before our era.

We have already considered, under "Gold," its application then, in the form of plates coated with gold, to the mounts of the scabbards of swords, the ornamental appendages of the personal attire of warriors, and the decoration of the trappings of their horses. These plates, or sheets of copper, are extremely thin, often not thicker than ordinary writing-paper, and could only have been produced with the metal after it had been first carefully purified. In this preparation the early Japanese had attained results which we look for in vain elsewhere until many centuries later.

It is interesting to note that in the refining and preparation of copper in Japan, up to our own times, the method of heating the crucibles—viz. by placing the fire above them instead of below and around them, as is the modern practice—is precisely the same as that followed in the prehistoric Bronze Age, and is a survival of it, the only survival known to me.

The penannular rings, plated with gold or silver, mentioned under "Gold," are also among the earliest objects of copper. One which I found in the dolmen at Rokuya-mura was plated with silver. I made an analysis of it with the following results :

Copper	...	...	...	98.50
Silver	...	...	...	.20
Lead	...	...	...	.51
Iron	...	...	...	trace
Oxygen, etc.	...	...	...	.79
				<hr/>
				100.00

After the establishment of Buddhism, 593 to 621 A.D., especially in the brilliant epoch when Nara was the Imperial capital—709 to 784 A.D.—the art of metallic decoration by means of gilded copper reached a high point of excellence. The wooden architecture of temples and shrines was lavishly embellished with plates and plaques, richly ornamented not only with repoussé and punched work, but also with elaborate pierced designs.

Ceremonial vessels and objects of display for the altar, lanterns for the courtyards and interiors of temples and shrines, were extensively produced by highly skilled craftsmen.

Stimulated and supported in this work by a priesthood



TWO TAMAMAKI NO TACHI.



SUGARU NO TACHI.



fond of gorgeous display, the craftsmen of these early times achieved results which have not since been surpassed.

A typical example of the metal-work of this period is the famous lantern in the courtyard of the temple Tōdaiji, in Nara (two Plates). It is the oldest metal lantern in Japan, and is partly of bronze and partly of gilded copper. Its eight sides consist of plaques of the latter metal, bearing richly executed designs of Buddhist saints or angels, with fine arabesques in repoussé and pierced work. The Buddhist figures in their pose and drapery bear a close resemblance to the earlier wall-paintings of the temple Hōryūji, which show markedly the influence of Chinese Buddhist art.

The most important examples of the decorative use of gilded copper of this date are swords, with the exquisitely wrought mounts of their scabbards of copper coated with gold and silver, now forming part of the sacred treasury in the temple of Tenshōko-Daijin (*Amaterasu O-mi-kami*) in Ise. They are among the first examples of the curved sword which succeeds the straight sword of the Dolmen Period.

The three swords shown in Plate XIV. were found buried in the ground on the north-east of the north gate of the temple when making an excavation for a sacred enclosure (Mikaki) in 1869.

In the *Chōreki So Kwan Fu*, and in the *En-gi Shiki*, it is stated that in the period Chōreki (1037 to 1039 A.D.) there were twenty-one swords with mounts of copper, coated with gold, among the sacred treasures of the temples, and one is mentioned as having a metal ring attached to the hilt. The specimens illustrated are hence not later than 1039 A.D., and I am strongly of opinion that they date from the brilliant period in Japanese history when Nara was the capital city (709 to 784 A.D.), or very shortly afterwards. The designs which I have seen at Nara in specimens of incised work in copper, of the time of the Emperor Shomū (724 to 748 A.D.), confirm me in this opinion.

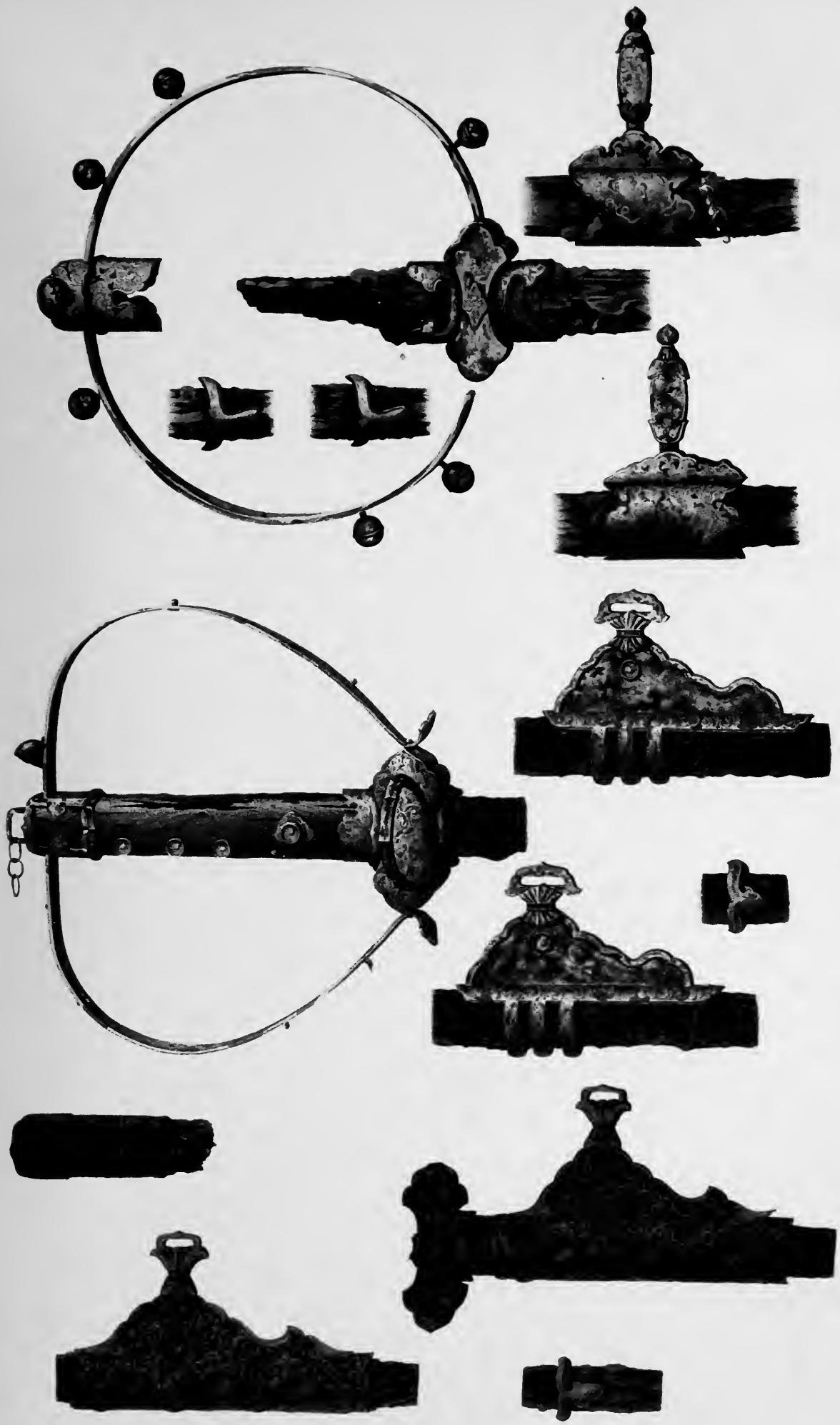
The mounts of these swords, which are shown in detail in Plate XV.,* are richly ornamented in engraved and repoussé work so superbly executed that it has never been surpassed by any artists in metal. A curious feature in two of them is the large delicate ring of metal attached to the hilt, to which, in the upper example, are affixed small bells. The total length of

* From Joly and Inada, *The Sword and Samé*, p. 14.

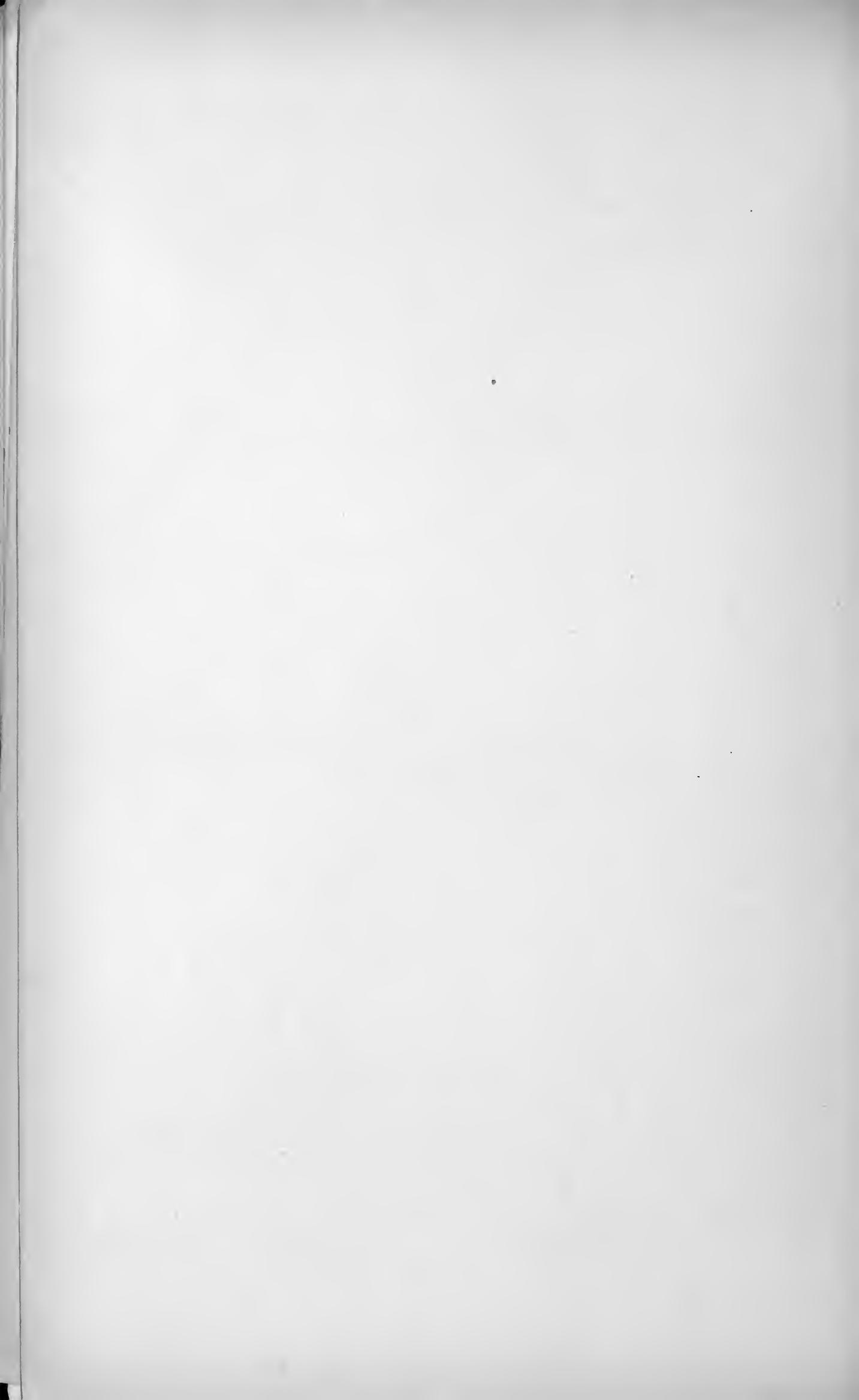
this sword is 3 ft. 3 in. A string of three hundred beads of precious stones (probably enamel or glass) of five different colours is tied round the sheath. The mounts of the bottom sword are said to be silvered in parts. They are masterpieces of the metal worker's art, not only on account of the beauty of their designs and the perfect adaptation of these to the forms of the mounts, but also from the skill in handicraft displayed in their execution. During the ten centuries which have elapsed since their date but few specimens of repoussé work have been produced which equal them, even by the great masters of the seventeenth and eighteenth centuries. Other examples of an early period are salvers of gilt copper, which were used in Buddhist ceremonies.

The removal of the court from the old art-centre Nara (784 A.D.), and subsequent civil wars, resulted in a break in the continuity of the art of the old coppersmith; a period of stagnation set in, and it is only near the end of the twelfth century, during a short term of peace established by the victories of Yoritomo, that we find the first signs of a renascence. During this period of stagnation in his art he appears to have lost the skill and forgotten the traditions of his famous predecessors, so that for almost four centuries of the renascence he is content with such simple designs that, had not so many of the art-works of the brilliant Nara Period been preserved, his work during this time would be regarded as the beginnings of art-metal work. Copper coated with silver and with gold were employed as before, but nothing approaching the old Nara objects in beauty of form or ornament was produced in copper until comparatively modern times.

Examples of architectural decoration of the beginning of the seventeenth century are two gigantic fishes—*shachihoko*, so-called dolphins—which adorn the ridge of the roof of the chief tower of the castle of Nagoya. They are about nine feet in height, and were erected by a famous general, Kato Kiyomasa, on his return from the Korean expedition in 1610 A.D. They were said to be of solid gold, and their value had been estimated at £25,000 sterling. Some years ago I had an opportunity of examining one of them, and found that, like many objects of historical interest, they are not what tradition represents them to be, but are only of copper coated with gold.



DETAILS OF FITTINGS OF THE TAMAMAKI NO TACHI AND SUGARU NO TACHI.
(Joly and Inada, *The Sword and Samé*, 1913.)



They are constructed of thin plates of the metal riveted and soldered together, and are the largest examples of gilt copper-work in the country.

In later times, especially during the last two centuries, we find copper in extensive use as a decorative metal for vessels and utensils for domestic use, and for the mounts of swords and the like. In such cases the metal is but seldom gilt; the craftsman relies on the richly coloured patinas in shades of brown and red which he produces on its surface for giving beauty and charm to his work. A specimen of the latter end of the eighteenth century, shown in Plate XVI., is a kettle for heating water, richly decorated with leafy scrolls in repoussé work, and bearing a fine brown patina.

A good example of the application of plain sheets of gilded copper to architectural decoration is afforded by the shrine of Amaterasu, the Sun-Goddess, in Ise. The original foundation is lost in the mists of antiquity, but immemorial custom decrees that it shall be razed to the ground, and be rebuilt once in every twenty years in precisely the same style. The building represented was erected in 1889, and, in accordance with Shinto canons, the metal is simply gilt, and bears no ornamental designs.

The alloys of copper, however, of which bronze is the chief, are of greater importance than the metal itself in Japanese art-work.

TIN AND LEAD.

Although tin ore is found in Japan in several localities, there is but one ancient mine in the country.

It is situated at Taniyama, in the province of Satsuma. The excavations of the old miners here are of a most extensive character, the hillsides in places being literally honeycombed with their burrows, indicating the production in past times of large quantities of the metal. No remains, however, have been found to give any clue to the date of the earliest workings. But, whatever may have been their date, the processes and appliances of the early smelters could not have been more primitive than those I found in use when I visited the mine in 1883.

The ore was roughly broken up by hammers on stone anvils, then reduced to a coarse powder with the pounders.

used for decorticating rice, the mortars being large blocks of stone with roughly hollowed cavities.

It was finally ground in stone querns, and washed by women in a stream to remove the earthy matter and foreign minerals with which it was contaminated.

The furnace in which the ore was smelted is exactly the same as that used for copper ores (fig. 12), excepting that it is somewhat less in diameter. The ore was charged into it wet, in alternate layers with charcoal, and the process was conducted in precisely the same way as in smelting oxidized copper ores. The tin obtained was ladled out of the furnace into moulds of clay.

The entire yield of each smelting charge was only about thirty pounds of metal, much being lost by volatilization and in the slag. Yet, with this primitive process and its rude appliances, the Satsuma smelters were producing tin at a cost not greater than that of the imported metal.

I have not met with any example of the use in Japan of tin alone for vessels or objects of any kind.

Lead also was but rarely used, and even at the present time copper is employed for many purposes for which lead is employed in Europe.

This is not owing, as I have already pointed out (p. 36), to a scarcity of the ores of the metal, as they occur extensively in many districts, but is due to their being treated as silver ores, as they are all argentiferous, and by such wasteful methods that the greater portion of the lead they contained was lost.

In the ninth and tenth centuries lead or pewter was used for coin, but no art-objects were ever cast in lead, or, if there were, none are in existence.

One curious application of lead, however, deserves mention —*i.e.* as an inlay for decorative purposes in the art-work of the old lacquerers.

The chief use of the two metals in Japan was in the preparation of pewter.

Pewter, an alloy of tin and lead, has been known and used in the Far East from a very remote date. It was, too, in extensive use by the Romans during their occupation of Britain, and many specimens of it—vases and other vessels, plates



CAST COPPER KETTLE.

(Gowland Collection.)



CAST IRON KETTLE WITH HONZOGAN DECORATION.

and large dishes—have been dug up on the sites of Roman cities.

Its first use in China takes us back to several centuries before our era.

But there appears to have been a prejudice against its use for domestic vessels in that country owing to the curious beliefs which prevailed, not only in early times, but even as late as last century, regarding the origin of tin.

Vessels of pewter had been occasionally found to communicate poisonous properties to wine which had been kept in them ; this the old Chinese philosophers attributed to arsenic, for, said they, it is a well-known fact that tin originates from arsenic by the influence of the feminine principle of Nature, acting for a space of two hundred years ; therefore, tin used in making pewter must sometimes be a mixture of arsenic and tin, when sufficient time has not elapsed for the complete conversion of the former into the latter metal.

In Japan, the first record of its use, or rather misuse, is contained in an edict dated 716 A.D., prohibiting counterfeit coining, and making the mere possession of any pewter a penal offence.

But this edict does not appear to have been long in force, as in the reign of the Empress Shōtoku (765 to 770) vessels and utensils were largely made of the alloy from tin found in the country.

The earliest specimens of pewter I have seen are some spoons and plates of that time which are in the treasury of the ancient temple, Tōdaiji, Nara.

In the tenth century it was used as mounts for the edges of lacquer-boxes, and later for ornamental inlays in lacquer. At present it is chiefly employed in the manufacture of tea-jars and canisters and a few other domestic articles ; also for the sacred vessels used in offering wine at Shinto shrines.

There are no specimens of Japanese pewter which approach in beauty the elaborately decorated masterpieces of Europe of the seventeenth century.

In the art of working it the Japanese craftsmen seem never to have put forth their skill. The metal was not in favour with the Buddhist priesthood ; it was unsuitable for the

decoration of the sword, and was hence neglected by the great masters in metal ornament.

The composition of old Japanese pewter is practically the same as that prescribed in the fourteenth century by our own Pewterers' Company for the manufacture of pewter plate. A choice specimen, a tea-jar of the eighteenth century, which I analysed, contained :

Tin	...	...	...	79.03
Lead	...	...	...	21.26
<hr/>				
				100.29

I need hardly say that I did not find any arsenic present.

The operation of casting pewter is a very simple one.

The metal is melted in an iron pan. The moulds are of clay, and for ordinary objects are made in two pieces, so that they can be used many times. They are filled with the pewter by means of a ladle, and as soon as each is full an iron rod is pressed on the metal, in the orifice by which they have been filled, to force it into every part of the mould. These castings are always in a more or less rough form, and their proper shape is given both to their exterior and interior by turning on a lathe. After the vessels have been turned they are carefully polished, first with the dried stems of a species of equisetum, and finally with the leaves of the Celtis Muku.

The decoration of Japanese pewter is rarely in relief. Chased, punctured, or pierced designs, to which additional richness is given by inlays of copper, bronze, and even of gold, are most frequently seen ; but generally the surface is left entirely plain, and the beauty and value of old pewter depends entirely on the fine grey mottled patina which the plain surface assumes, after the lapse of sufficient time, by simply rubbing with silk.

BRONZE.

The art of casting bronze has been practised by almost all nations from very early times. In Europe at a remote period, long before the dawn of history, we have numerous examples of the skill of primitive man as a founder of bronze. Weapons of defence and implements of the chase are the chief specimens of his earliest work, but later, when other wants arose beyond the bare necessities for his existence, we find together



MIRRORS FROM DOLMEN IN HIGO.



BRONZE DOTAKU (Tokyo Imperial Museum).

with them objects for personal adornment and domestic or ceremonial uses.

In Western Asia the earliest practice of the art is shrouded in the mists of an extreme antiquity. Certain bronze figures from Chaldæa are attributed to a period not later than 2000 B.C., and, although of archaic form and rude execution, indicate that the casting of bronze must have been followed in that country even before that remote date.

In China, according to ancient records, an almost equally remote date is claimed for bronze. At the beginning of the Hsia dynasty (2205 B.C.) it is recorded that the Emperor Yu cast the famous bronze Tripod Cauldrons from metal sent up from the nine provinces, which were preserved as palladia of the empire until about the third century B.C.

In Japan the founder's art has a much less antiquity; it does not extend back to these distant periods, in fact, no remains of any metal castings, even of weapons of defence, have been found there approaching in age even those of the Bronze Age in Europe.

From the evidence afforded by the remains found in the simple burial mounds which formed the sepulchres of the early Japanese several centuries before our era, bronze would seem to have been the first metal known to the race. The metallic remains of that early period we have already considered. The wants of the people were evidently few and simple, their known weapons being only halberds, spears, arrow-heads, and possibly swords of bronze, their personal ornaments being made exclusively of steatite, jasper, quartz, and other stones.

The race had then, however, made considerable advance in civilization, as in the earliest stages of all races, during the Bronze Age, celts or axes are the first weapons we meet with, halberds only being found near the end of that age, or in the transition period between bronze and iron, and in Japan no bronze celts have yet been found.

Somewhat later, but still before our era, after the Japanese had become builders of dolmens for the interment of their distinguished dead, bronze halberds, spears, and swords disappear, although arrow-heads survive, and the chief objects of bronze which have been discovered are mirrors and small bells, the latter being used as appendages to the dress of

warriors, the trappings of horses, and for other ornamental purposes. The bells, which are of the form called by the Japanese *suzu*, are simple hollow spheres with a slit cut in the lower half, and contain a loose piece of metal or a small round pebble to serve the purpose of a tongue. Remains of these I have found in several dolmens.

The early use of these bells is seen on the head of a terra-cotta horse of the early centuries of our era (Plate IX.) and in later times on the hilts of swords (Plate XIV.).

Bronze mirrors are the earliest examples of art castings in Japan. Many are decorated with designs which denote an advanced stage in the art of moulding and casting.

Those represented in Plate XVII. were taken from the Higo dolmen, some of the contents of which we have already considered. Five are Chinese and are not later than the fourth century. The smallest, with simpler designs, is Japanese.

The largest castings of the early Iron Age are curious bell-shaped objects,* which are of special interest from their form and archaic ornament. The one shown in Plate XVIII. is 4ft. 6in. in height and does not exceed $\frac{3}{16}$ inch in thickness. It has been conjectured that they are temple bells, but they present no points of resemblance to these or to any instrument or object connected with the ceremonies or observances of Buddhism, and are in fact of earlier date than the introduction of that religion into the country. Moreover, none show any signs of having been hung. A considerable number have been found—always buried in the ground—chiefly in Yamato, Kawachi, Tōtōmi, and the neighbouring provinces. As early as 669 A.D. the discovery of one is recorded, and was then regarded as being of such a great antiquity that it was presented to the Emperor.

The designs with which they are ornamented—the simple geometric line patterns common to many primitive races—are also evidences of their great age. They vary in dimensions from 1 or 2 inches to $5\frac{1}{2}$ feet in height, those measuring 1ft. 6in. to 3ft. 0in. being most common, and all are of extreme thinness compared with their size. Their exact use and age are still a subject of dispute among archæologists.

* *Dōtaku*, "Large Metal Bell," cf. Munro, *Prehistoric Japan*, p. 319, sqq.—[ED.]



BRONZE LANTERN (Tōdaiji Temple, Nara).



PANEL OF BRONZE LANTERN (Tōdaiji, Nara).



These castings are of great importance in the history of bronze-founding. They could only have been produced by the *céra perdue*, or wax process, and by the use of a hot mould.

SEVENTH AND EIGHTH CENTURIES.

Two events of marked importance in Japanese annals, on account of their influence on the development of the arts and culture, occurred during this period. Buddhism, which had been introduced about 552 A.D., had been adopted as the religion of the country, through the energy and enthusiasm of Prince Shōtoku Taishi (593 to 621 A.D.), and a fixed capital and court had, for the first time in Japanese history, been established at Nara (709 A.D.). These two centuries form a brilliant epoch in the history of the art of bronze-founding, as in that of the sister arts of painting and sculpture. Numerous temples, some on a scale of great magnificence, were erected for the services of the new religion, and the skill of both native and foreign workers in bronze was specially enlisted for their decoration, as well as for the production of statues of the divinities of Buddhism and of vessels for the ceremonies of its ritual.

We have already seen the effects of the establishment of Buddhism in Japan in advancing the art of the workers in copper in the seventh and eighth centuries, but to even a greater degree the development of the art of bronze-founding and the encouragement of its craftsmen were due to the priests of that religion. So that, during this period and for some centuries later, the chief works in bronze were images of the divinities and saints of Buddhism, and lanterns, bells, and other objects for its shrines.

Unfortunately many of their works have been destroyed by conflagrations, but a few have been preserved, which are masterpieces of the art of the modeller and founder.

Many tales record the enthusiasm with which the founders of the time were supported by their patrons, and of the stubborn manner in which, after many repeated failures, they overcame the difficulties which beset them.

The Empress Kōken (749 to 758) herself is said to have aided the founders in stirring the molten metal for a statue of

a Buddhist saint, which was only completed after six unsuccessful attempts.

Japanese records and traditions relating to the works of art of this epoch, whether of the painter, sculptor, or founder, invariably speak of the help afforded in their production by Korean or Chinese artists, and not a few of the ancient examples which survive are even attributed solely to them.

It is very difficult to determine how far these traditions relating to Korean artists are trustworthy, as no traces of similar works have been found in Korea itself; yet they all present such a close agreement on the point, that we are almost compelled to acknowledge that if not, perhaps, true in the details they give of individual artists, yet, broadly speaking, they may be based on facts, and that the Japanese owe to Koreans, and also to Chinese who may, perhaps, have come through Korea, the first great advances which they made in the casting of bronze.

Besides the influence which the neighbouring countries, China and Korea, had on the technique and motives of the Japanese bronze-founder, we have also abundant evidence of the influence of the art of more distant regions. Amongst the treasures of the temple Hōryūji (near Nara, Yamato) are several bronze statues of Indian origin of Buddhist saints and divinities, and a curious ewer, all of which are said to have been in the possession of the temple from the date of its erection in the early part of the seventh century. The characteristic pose of the figures, the modelling of their features, and their jewelled headdresses, have been frequently copied with more or less modification, and can be distinctly traced in many ancient Japanese statues, as well as in some of comparatively modern times.

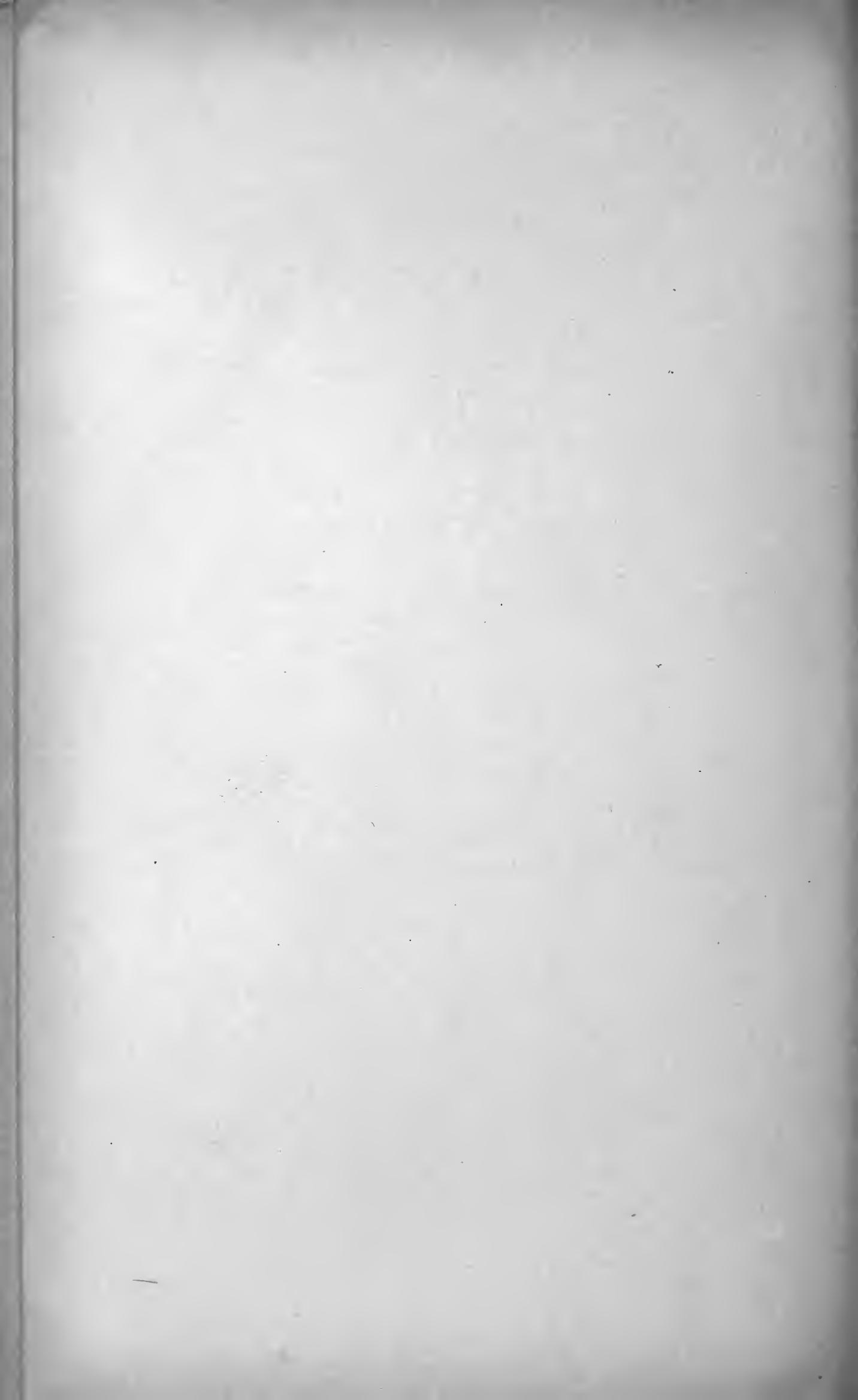
This ewer, a bronze casting of graceful form, is decorated with figures of winged horses of the form of the Pegasus of the ancients.

According to Longperier (Gonse, L'Art Japonais) it is undoubtedly Sassanian, and of earlier date than the seventh century. An illustration is given of it in the handbook of the ancient articles in the temple.

During this epoch, especially that part of it which has been styled the "Nara Period" (the seven reigns during which



SAKYA TRINITY (Kondo of Hōryūji Temple).



Nara was the capital, 709 to 784), the great development in bronze-founding was not the only advance made in the working of metals; but the art of incised and *repoussé* work in gilt copper, which had been practised during the Dolmen Period, was brought to a stage of perfection beyond which it has never passed.

The examples contained in the following list I have selected as representative specimens of the art of bronze-founding during this period (seventh and eighth centuries).

One of the most important of the ancient bronzes is the seated figure of Yakushi, the Æsculapius of Japan, in the temple Yakushiji, near Nara. The image is of gilt bronze, about nine feet in height, and has on its right and left the minor divinities Nikkō and Gwakkō. The date of the Trinity is about the end of the seventh century. In the same temple is a standing figure of Kwannon, attributed to Korean artists. According to the temple records it is made of the fabulous gold Embuda-gon, from the sands of the river at the base of the mythical mountain of Buddhism, Mount Meru or Sureru, the four sides of which consist respectively of gold, silver, lapis lazuli, and glass. It is, however, only bronze.

Also in this temple are three fine bronzes representing a Buddhist Trinity, Amitabha with Kwannon and Seishi (Mahasthamaka), cast in the reign of the Empress Jitō (690 to 702 A.D.).

Plate XXI. represents the Sākyā Trinity of the Kondo of Horyuji, near Nara, which, according to the temple records, was cast in 623 by Kuratsukuri no Obito Tori, to the order of the family of Shotoku Taishi.

In Plates XXII. and XXIII. are shown the famous Trinity in the Shrine of Tachibana Fujin (Hōryūji temple, between 700 and 733). The floor plate is modelled in low relief with waves and lotus, and the three-fold hinged screen is a masterpiece of minute modelling and fine casting. This group is considered to be the most exquisite example of early bronze casting in Japan, just as the Yakushi of the Kondo of Yakushiji, in Nara, stands at the head of the larger bronze work.

One of the most interesting of the smaller objects is a spherical box of gilt bronze, bearing the date 705 A.D., which was found in a stone sarcophagus at Tennōji, near Osaka, as

it is probably the oldest dated piece of metal work in the country.

According to Japanese histories copper is said to have been discovered in the country in 698 A.D., but the accuracy of this statement for many reasons is open to doubt, and the discovery chronicled doubtless only relates to the finding of deposits of ore of more than usual extent and richness.

In 708 A.D., bronze coins—Wadō-zeni—were cast, the earliest coinage in Japan of which there is any record.

The issue of this coinage, which was cast from copper from these deposits, was regarded as an event of great national importance, and to commemorate it the "Nengō," or name of the period by which the series of years is distinguished in Japanese chronology, was altered to "Wa-do," which signifies "Japanese copper." Besides these, there were three other distinct coinages during this century.

In 732 the great bronze bell of the temple Tōdaiji in Nara was cast. Its approximate dimensions are: height 13ft. oin., diameter 9ft. oin., thickness 8 to 10in. Its weight cannot be easily determined as its thickness is variable, but at the lowest estimate cannot be much less than 40 to 50 tons.

The eighth century is also noted for the casting, in 749 A.D., of the colossal image of Rōchana or Vāirōtchana in the temple of Tōdaiji, commonly known as the Nara Daibutsu.

This is the largest bronze figure in the country. It has not, however, been cast in one piece, but is constructed chiefly of numerous pieces of comparatively small size. Some of the lower portions have been cast by building up the mould on the parts already finished, but the greater part of the image consists of separate castings which have been united by running in an alloy containing large proportions of tin and lead between their edges.

The following dimensions are those given on a wood engraving of the image—one of which was exhibited—sold by the priests of the temple, and may be considered as only approximately accurate :

Height ...	...	...	...	53·2 feet.
Breadth of face	...	...	9·4	"
Length of eye ...	...	...	3·9	"
Thickness variable	...	3 to 6	inches.	

AMIDA TRINITY OF TACHIBANA FUJIN SHRINE (Hōryūji Temple).







SCREEN AT BACK OF AMIDA TRINITY (Tachibana Fujin Shrine, Hōryūji).



The figure is seated on a huge lotus flower with fifty-six external petals, each of which measures 10 ft. 6 in., and appears to be a single casting. Twice it has been partially destroyed by conflagrations and once by an earthquake.

The present head, cast in the sixteenth century, is extremely ugly, destitute of any trace of the grace and refined expression of the earlier statues, and not at all in harmony with the ancient parts of the figure.

The authorities of the temple state that the image is composed of *shakudo* (a copper alloy containing 3 to 5 per cent. of gold); they also give the weights of the copper, tin, gold, and mercury which were used in casting it, and these statements have been repeated by many writers. They are altogether without any foundation in fact, I have had many opportunities of examining it, and although I never succeeded in getting a portion for analysis, yet from the streak, hardness, and colour of the metal it is undoubtedly a variety of ordinary *karakane* (a copper-tin-lead alloy), and the gold and mercury said to have been used in its manufacture were simply employed for gilding its surface and not as constituents of the alloy of which it is cast. Four hundred and fifty tons of metal are said to have been used in its construction. If its average thickness is as much as 5 inches, and it is probably less, its weight must be less than 200 tons. The two following objects are examples of the smaller works of the period :

A bronze bell (Plate XXIV.) with curious ornamental tongue, now in the temple Tōdaiji (Nara), dated second day fifth month first year Tembiō Shōhō (749 A.D.). This is of special importance as it is another of the earliest bronzes which bears a date, but unfortunately no artist's name.

A gong-shaped bell (Plate XXV.) suspended between two well modelled dragons, belonging to the temple Kofukuji in Nara, is attributed to this period.

A small brazier, or incense burners, of extremely elegant form and decoration, attributed to the Nara Period, is shown in Plate XXVI. It is one of the treasures of the temple Tōdaiji, Yamato. I have not seen it, but it is said to be of gilt copper and the animal figures of gilt bronze. It is ornamented with delicate chased designs and inlaid coloured enamels. The handle is of the Chinese wood *shitan*.

A painting of the ninth century represents Shōtoku Taishi holding one of these braziers. It was doubtless used in Buddhist ceremonies.

Near the close of the preceding epoch the court was removed to the city of Kyōtō, which from that time (794 A.D. up to 1868) continued to be the imperial capital. This removal of the court was a severe blow to the art life of the ancient city, and the works and traditions of its old bronze-founders soon appear to have been forgotten or neglected in the new metropolis.

From the beginning of the ninth until near the end of the twelfth century, a space of nearly four hundred years, we have a period of stagnation if not of decadence in all art, yet strange to say it embraces the golden age of literature during which the famous classical romances were written. Its first half, as shown by these romances, was marked by effeminacy; during its second the country was plunged in civil war. The romances give us but little information of the individual and art life of the people, and the pages of its histories are solely devoted to records of the jealousies and feuds of the great families of Fujiwara, Taira, and Minamoto.

Until near its termination we have no record of the erection of any temple of note, or of the execution of any great artwork, and I have been unable to find any examples of the art of the bronze-founder during the entire period, excepting two insignificant boxes for holding seals (dated respectively 998 and 1098 A.D.) and nine distinct coinages of bronze money from 810 to 958 A.D. After this last date even the coinage of bronze money appears to cease, and is not resumed until 1457 A.D., five hundred years afterwards.

During the last years of the twelfth century, when peace was established throughout the country by the victories of Yoritomo, there are, as I have already stated, under "Copper" the first signs of a revival of the old art of the Nara period. From 1190 A.D. up to the date of his death (1198 A.D.), this remarkable warrior devoted his energies to the cultivation and advancement of the arts of peace. Stimulated by his example and enthusiasm the artistic spirit of the people was aroused from its dormant condition, and for nearly a hundred years we have a notable period of renaissance in art.

BELL, dated 749 (Shosoin).







KWAGENKEI, in Kōfukuji monastery.



A period chiefly remarkable in the history of bronze for the casting of that magnificent masterpiece the colossal image of Amitābha, usually called the Daibutsu of Kamakura. This image, one of the finest examples of bronze-founding, cannot be adequately described by any word painting; it must be actually seen in the midst of its grove of conifers and evergreens to appreciate fully its grandeur and beauty, its soberness of design, and noble expression of majesty and repose. It stands alone and incomparable among all the *chefs d'œuvre* of Japanese bronze-founders.

Although slightly smaller than the great Buddha of Nara, it far excels it in artistic execution. Like it, it has been cast in segments, but these have been burned together with bronze of similar composition to that of the image itself, the exterior of the joints having been subsequently finished by chiselling.

Japanese histories relate that it was cast about the middle of the thirteenth century (begun 1252 A.D.) by Ono Goroyemon, one of the first bronze-founders whose name is recorded. Its dimensions, taken from a woodcut sold to pilgrims, who visit its shrine, are as follows:

Height ...	... 49 feet 7 inches.
Length of face ...	... 8 " 5 "
Breadth from knee to knee	... 35 " 8 "

The measurements of both this and the Nara Buddha, however, require revision, the heights in both cases are, I think, exaggerated, and should have six or seven feet deducted from them.

Its thickness is variable, ranging from $1\frac{1}{2}$ inches to 3 or 4 inches, or even more in some of the castings, and its weight will not probably exceed 150 tons.

Other bronze images of the divinities of the Buddhist hierarchy, of less colossal proportions and of varying degrees of excellence, were made for the temples of Yamato and Kyōtō, one of the chief groups being a Trinity for the ancient monastery Hōryūji.

Several bells were also cast, one at Kamakura being worthy of note, as the record given of it indicates the source of the metal from which they were occasionally made. It is said that three hundred thousand copper coins, which had been collected by the priests of the temple, were melted down for

casting it, and the metal being insufficient the casting was a failure; thirty thousand more coins were then collected for addition to the defective bell when it was remelted. It is also recorded that copper coins were similarly melted up for casting Buddhist images and ornamental utensils; it would hence appear that it was not then deemed necessary to use a different alloy for bells and art castings than for coins.

FOURTEENTH AND FIFTEENTH CENTURIES.

During the fourteenth and fifteenth centuries we have again a period of decadence with the exception of two short brilliant intervals, the first during the supremacy of the Ashikaga Shōgun, Yoshimitsu (1368 to 1393 A.D.), and the second during that of Ashikaga Yoshimasa (1449 to 1471 A.D.). For the greater part of this period the country was again in a state of unrest and intestine conflict, and the arts of peace found but little encouragement excepting so far as they contributed to the needs of war.

Workers in iron and steel are brilliantly represented by one of the greatest of the famous forgers of sword blades, Masamune, and by several distinguished armourers and smiths of the renowned Miochin family; but the bronze-founder was not in request.

The chief work during these two centuries was a colossal figure of the Buddha Vāirōtchana, cast during the time of Yoshimasa for the temple of Kwannon at Hase (Kamakura). I have not seen this image, but it is said to be an admirable casting and to measure 3oft. 6in. in height.

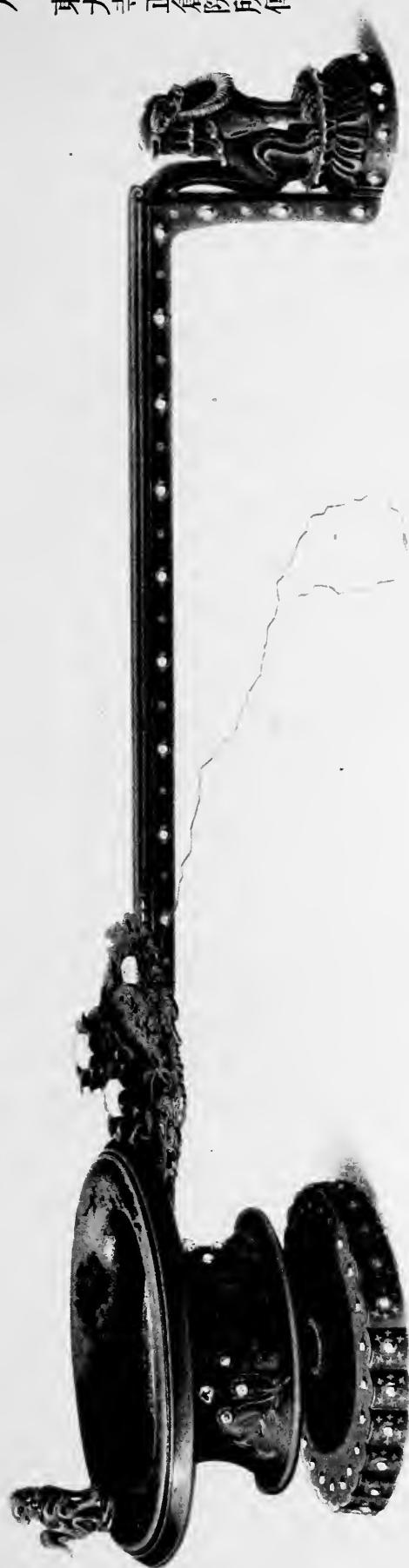
Two bronzes, which were exhibited at Nara in 1888, represent the smaller castings of the period, one an incense-burner which was presented by the hero, Kusunoki Masashige (first half of the fourteenth century), to the temple at Hase (Yamato), and a war bell also given by him to the Emperor Godaigo.

SIXTEENTH CENTURY.

In the last decade of this century, after another period of civil war, the patron of art and culture is again a famous warrior, Hideyoshi (often known as Taikō-sama). Although then engaged in war with Korea, the closing years of his life were devoted to peaceful pursuits at home, and in imitation of Yoritomo at Kamakura he erected a huge Buddha and a

紫檀柄香爐

御物
東大寺正倉院所傳



INCENSE BURNER INLAID WITH RED AND TURQUOISE JEWELS.



temple to contain it at Kyōtō. On the destruction of the image, which was of wood, by an earthquake only eight years after its erection, he contemplated replacing it by one of bronze, but the execution of this was delayed by his death (1598 A.D.), and was only accomplished by his son and widow sixteen years afterwards.

No large bronzes of importance appear to have been cast during this century.

A figure of Yakushi, the Healing Divinity, in which the deity is represented holding a crystal ball in his left hand, once in the Alfred Cocks collection, was a good specimen of one of the smaller bronzes. It was a votive offering bearing the name of its dedicators to the temple and the date Ei-roku, twelfth year (1569 A.D.).

Another example is a bell of the form known as "waniguchi," crowned with the figure of a tortoise encircled by the coils of a snake, in the possession of my friend Mr. Harding Smith. It also bears the name of its dedicatory and the date Bunroku, second year (1593).

Dedicatory bronzes of this time are to be found not only in Buddhist temples but also in Shintō shrines. Two examples of the latter may be mentioned, although they are notable rather for the fame of their donors than for their artistic excellence; a gigantic bell of similar form to the last, offered by Hideyoshi to the Shintō shrine at Nachi Kyūshū; and a large mirror (three feet diameter) dedicated to the Tenjin no Miya at Kitano (Kyōtō) by Kato Kiyomasa, one of Hideyoshi's generals in the Korean campaign.

A magnificent bronze in the famous Cernuschi Collection in Paris which is attributed to this period is shown in Plate XXVII.

It is supported on a pedestal of rich open work, and is decorated with gourds and a heraldic representation of the leaf and flowers of the Paulownia imperialis.

SEVENTEENTH CENTURY.

In 1603 A.D. the advent of the great renaissance is ushered in by the establishment on firm foundations of the Japanese system of feudalism by the warrior and statesman Iyeyasu, the first of the Tokugawa shōguns. During the supremacy of these military rulers, which only terminated in 1868, all

craftsmen were stimulated and encouraged to bring their respective arts to the highest point of excellence, and it is in no small degree due to the works produced during this period that Japan owes the prominent position she so deservedly occupies in the world of art.

The first great work of the bronze-founders of the seventeenth century was a colossal figure of the Buddhist divinity Rōchana in Kyōtō, to replace the wooden image destroyed by an earthquake in the previous century, and a huge bell for its temple.

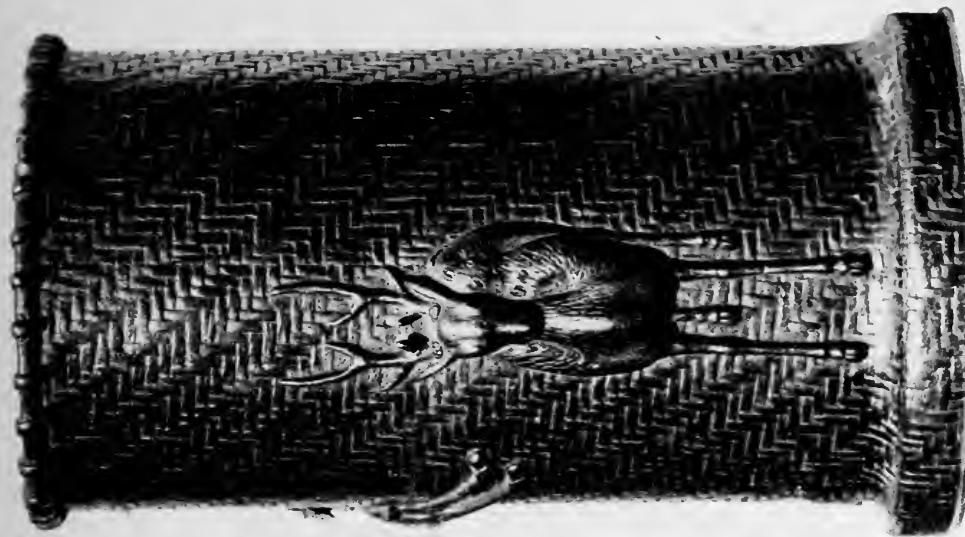
The figure is said to have been $58\frac{1}{2}$ feet high, and from the records regarding the first attempt to cast it, it would appear that it was cast *in situ* and in segments, the mould being built up on the parts already finished. It would thus, when completed, have been practically a single piece of metal. This attempt was a failure, as when casting the lower part of the head the wooden scaffolding was set on fire by the operations and the image partly melted. It was successfully completed in 1614, but only forty-eight years afterwards, like its wooden predecessor, it was destroyed by an earthquake.

According to official records, its fragments were melted in 1668 to 1683 and cast into bronze coins Kwan-ei-tsū-ho, popularly called Bun-sen.

This record is interesting as it affords another proof that the alloy used by bronze-founders did not differ much in composition, if at all, from that in use at the time in the mints for coins. I have analysed these coins with the following results.

Seven thousand six hundred pieces were melted together, and the resulting metal was found to consist of

Copper	...	...	...	...	77.30
Tin	...	...	...	...	4.32
Lead	...	...	...	...	15.33
Arsenic	...	...	...	...	1.14
Antimony	...	...	...	...	.31
Zinc	...	...	...	...	nil
Iron	...	...	...	...	1.01
Silver	...	...	...	...	.06
Sulphur	...	...	...	...	.52
Gold	...	...	...	...	trace
					99.99



BRONZE VASE, by Teijo (Musée Cernuschi).



BRONZE VASE (Musée Cernuschi).



We may hence not unreasonably conclude that this represents approximately the composition of the alloy which was used for casting the colossal Buddha.

The bell in the Kyōtō Daibutsu-dō is the largest in Japan. Its dimensions are approximately :—height 14ft. 0in., external diameter at the mouth 9ft. 0in., thickness at the rim $10\frac{3}{4}$ in.

In section these bells differ from European forms, in having the rim thickened internally so that their mouths are constricted. And it is this constriction which causes the gentle rising and falling tones which characterize the boom of all Japanese bells.

It is hardly necessary to mention that these bells are not swung, neither are they furnished with tongues, but are rung by striking the outside by means of a beam of wood suspended from the bell tower and swung like a battering ram. The point struck is a low boss, which sometimes has the form of a lotus flower.

Two other similar bells were cast during the first half of this century (seventeenth), details of which are given in the following table :

TABLE OF APPROXIMATE DIMENSIONS, &C., OF FOUR OF THE LARGEST TEMPLE BELLS IN JAPAN.

Date	Name of Temple	Height	External diameter at the mouth	Thickness of rim	Approximate weight
		ft. in.	ft. in.	in.	tons
Eighth century	Todaiji, Nara	12 9	8 10	10	49
1603 A.D.	Dai-Butsu, Kyōtō	14 0	9 0	$10\frac{3}{4}$	56
1633 A.D.	Chionin, Kyōtō*	10 10	9 0	$9\frac{1}{2}$	43
1623-49 A.D.	Zōjōji, Tōkyō	12 0	... .	...	...

The exact average thickness of these bells cannot be ascertained without special measurements, which are not permitted, but it cannot exceed eight inches—the thickness I have assumed for the above calculations—and may possibly be somewhat less.

The casting of a large bell in old times in Japan was an important event, and was accompanied by religious ceremonies and popular rejoicings. On the day appointed for running the

* The weight of this bell is often erroneously given by writers as seventy-four tons.

metal into the mould a grand festival was held at the temple, in the grounds of which the founding operations were performed, and people of all ranks came from far and near with contributions, many with offerings of mirrors, hairpins, and metal ornaments, to be added to the bronze in the furnaces.

On one occasion, that of the founding of the great bell of Zōjōji, the shōgun himself (Iyemitsu) was not only present, but took part in the direction of the operations. In succeeding years the day was not forgotten, but its anniversary was celebrated by temple festivals.

The fame and repute of this "golden" period in the bronze-founder's art does not, however, rest on the above castings, which are chiefly remarkable for their size and weight, but on those now to be described, many of which are masterpieces of design, modelling, and technical skill.

The oldest of these are the bronzes cast for the mortuary, chapels, and tombs of the early Tokugawa Shōguns, and members of their families. At the famous mausoleum at Nikkō there are some grand examples, one of the most notable being the tomb of Ieyasu (the first Tokugawa Shōgun, died 1604 A.D.), a fine casting in bronze, with bronze gates, distinguished by impressive simplicity and chasteness of design (Plate XXVIII.).

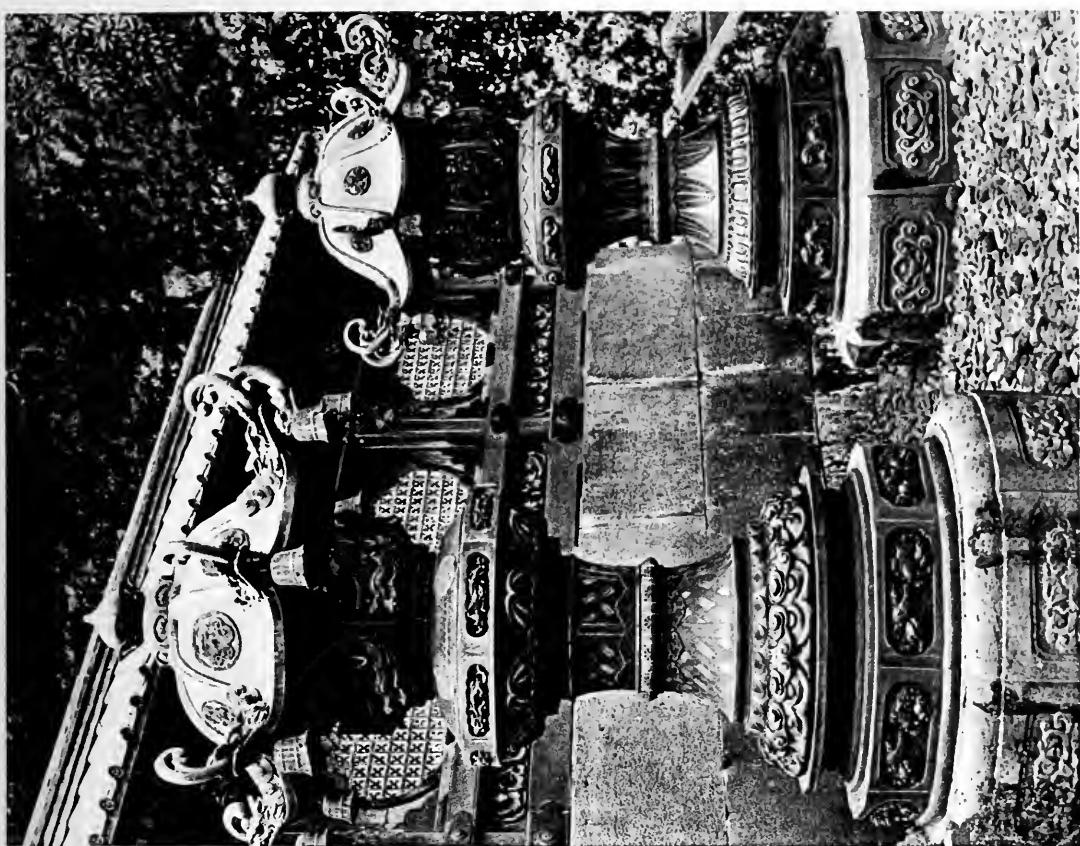
In front of the tomb are the three ceremonial ornaments (*sangusoku*) of the Buddhist altar—viz. a vase, incense burner, and candlestick, all of the severe style of the period.

The gates (Plate XXIX.) are splendid examples of bronze-founding. Almost their whole surface is covered with delicate diaper and floral patterns, upon which ground the bolder ornamentation is moulded in relief. These consist of representations of the *chakra*, or Buddhist wheel of the law, and floral designs, most of which are coated with gold.

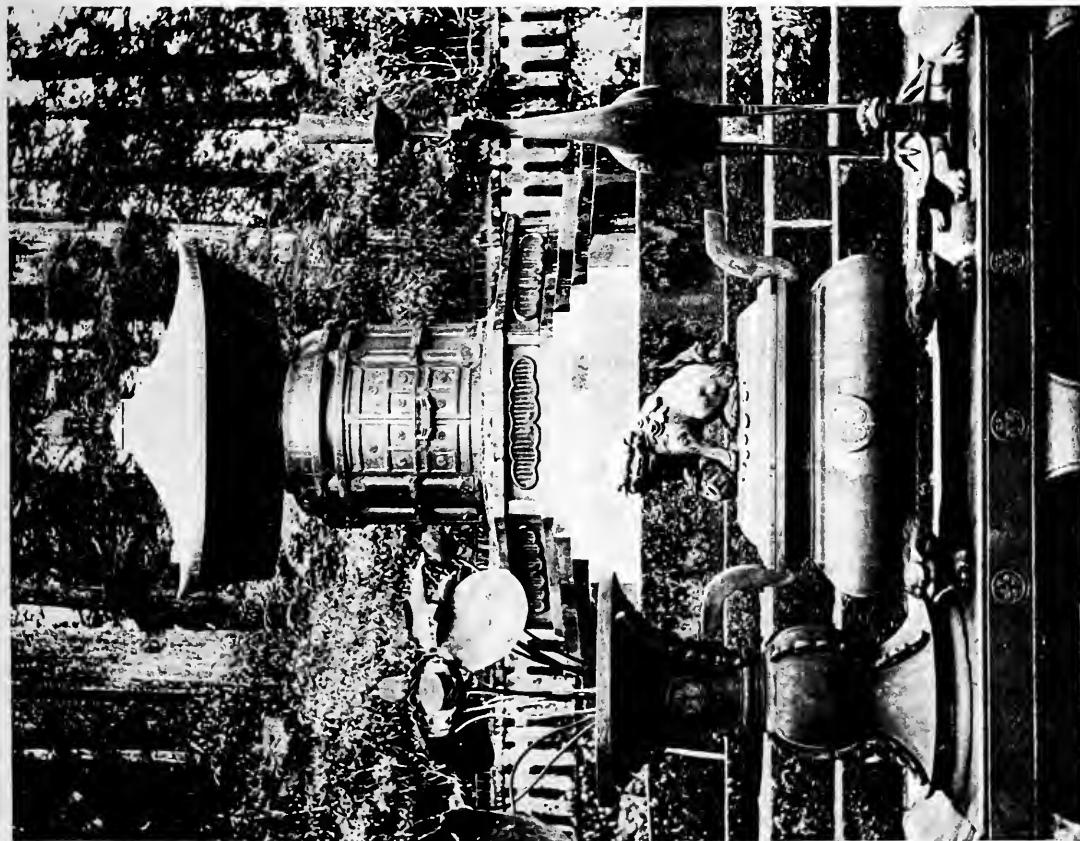
In front are the two fabulous animals (*koma inu* and *ama inu*), supposed to represent lions.

The tomb of Iyemitsu, the third Tokugawa Shōgun (died 1649 A.D.), closely resembles that of Ieyasu in form, but the reliefs on its bronze gates are simply sanscrit characters in medallions.

These tombs are situated in a grove behind the chapels and oratory, and their simplicity presents a striking contrast to the



LANTERNS (Nikko Mausoleum).



TOMB OF TOKUGAWA IYEYASU (Nikko).



magnificence of these edifices, which are the most richly decorated shrines in the world. It is said that their plain and simple design is intended as a concrete expression of the Buddhist aphorism that "at death there is an end to all magnificence."

Another important bronze at Nikkō representative of the period is a bronze column (1643 A.D.) termed *sorinto*, forty-two feet in height, a form of the Indian "stupa," as introduced into Japan through China. Before removal to its present site it stood near the tomb of Iyeyasu, and was doubtless erected there in accordance with the Chinese superstitious beliefs in the efficacy of such structures in warding off evil influences, and ensuring the protection of heaven.

Large standard lanterns (*toro*) of bronze, contributed by the territorial nobles, who vied with one another in thus doing honour to their departed chiefs, line the courtyards of the shrines. Many hundreds of these *toro*, which were favourite votive offerings of the wealthy, both to Buddhist temples and Shintō shrines, were cast during this period of revival in bronze-founding. They adorn the approaches and grounds of every temple of note in the country.

Each group or pair differs from any other, yet in outline and decoration all are in harmony, and if no other examples of bronze-founding were in existence, the gracefulness of form and fertility of design which characterizes all would alone mark their modellers and founders as artists of the first rank.

Two of these *toro* from Nikkō (Plate XXVIII.) I think fully confirm what I have just said.

EIGHTEENTH CENTURY AND FIRST HALF OF THE NINETEENTH.

Towards the end of the seventeenth and early in the eighteenth century the mausolea of other Tokugawa Shoguns afford some fine examples of the bronze-founders' art, notably the tombs of Iyetsuna (1650 to 1680) and Tsunayoshi (1681 to 1708) at Uyeno (Tōkyō), and of Iyenobu (1709 to 1712) at Shiba (Tōkyō). They are of similar form to those at Nikkō, differing from them chiefly in the more elaborate decoration of their gates. Finely modelled dragons and the armorial badge of the Tokugawas ornament the gates of Iyenobu's tomb,

whilst in the tomb of Tsunayoshi—who was a noted patron of the art—there is a still further departure from the simple style of earlier times, the symbolical combinations of the fabulous unicorn (*kirin*) and pine tree, the phœnix (*howo*) and paulownia, and of the pine, bamboo, and plum being, perhaps, almost too lavishly employed.

The imposing series of standard lanterns (*toro*) in the precincts of the temple Zōjōji, Tōkyō, were cast during this century. They were presented to the Shōguns Iyetsugu (1716) and Iyeshige (1762) by the territorial nobles, and are said to be more than two hundred in number. Two groups of six each are shown in Plate XXIX. Besides these four huge lotus petals for the base of the image of the Daibutsu at Kamakura were cast in 1717.

Before considering the later bronzes, I will endeavour to describe briefly the *cera perduta* process of casting by which the Japanese bronze-founder produced his famous masterpieces.

The founder himself was almost without exception of the plebeian class of the people, and although many at various periods were men of marvellous ability and of the highest merit as artists, yet they seem never to have ranked higher than artisans. The foundry of the artist always now forms part of his dwelling house, and doubtless this was the case in earlier times. A special feature in many is the well-arranged garden on which the modelling rooms open, so that the artist works amid cheerful surroundings which must influence his work for good.

In the *cera perduta* process of casting, the object is first carefully modelled in wax. A description of the preparation of an ornamental brazier will best illustrate the various operations.

A frame was made similar to that shown in fig. 12, as follows:

A sufficient number of flat strips of wood are prepared, their external edges being roughly cut to the shape of the interior of the brazier to be cast. These are arranged around the two discs of wood. Thin strips of bamboo or a cord of straw are now wound round the frame, covering its exterior. On this the exact form of the interior of the brazier is moulded in clay. The whole, which is termed a core, was then carefully



ENTRANCE GATE TO THE TOMB OF TOKUGAWA IYEYASU (Nikko).



MAUSOLEUM AT SHIBA (Tokyo).

dried, and after drying the brazier with all its ornamental designs was modelled on it in wax.

The wax model was now coated with a layer of fine clay. Other layers were added until the crust was sufficiently thick to give the requisite strength to the mould. The mould having been thus prepared was dried very slowly in a warm part of the foundry, and when dry its wooden frame-work was removed.

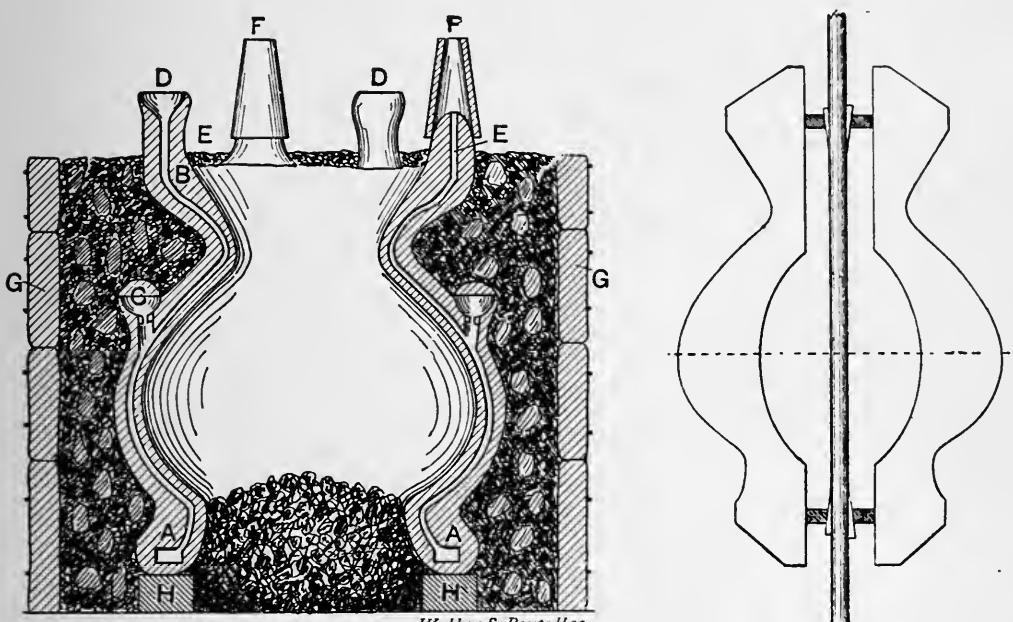


Fig. 13.—MOULD WITH OPEN CORE,
SHOWING THE MODE OF HEATING IT, AND
DETAIL OF COLLAPSIBLE WOODEN CORE.

- A, A, outer wall of the mould.
- B, B, inner wall of the mould (or core).
- C, C, lower ingates.
- D, D, upper ingates.
- E, E, vents or outlets for the air and gases.
- F, F, fireclay tubes.
- G, G, fireclay slabs.
- H, H, firebricks.
- I, I, ignited charcoal.

The mould (fig. 13) was now prepared for receiving the bronze by melting out the wax and heating it to dull redness. A wall of clay slabs was built up around it, and the space between the wall and the mould was completely filled with burning charcoal. The interior of the core was also partly filled with the same mixture. The mould was kept at a red heat until the metal was ready. The wall of clay slabs was

taken down and the fire raked away. The mould was then filled with molten bronze by means of ladles. As soon as the mould was cold it was broken from off the casting.

Previous to the eighteenth century the skill of the bronze-founders had been chiefly exerted in the production of colossal images and other huge castings for the temples of Buddha, and in giving a severe beauty to the form and ornamentation of utensils and implements for ceremonial purposes ; but during this period, with the continuation of peace, their art found a wider range in the designing of objects for secular use, for the decoration of the home, and the everyday needs of life.

Shortly before, the *okimono*, or ornament, a thing of no practical utility but only of display, had been introduced, and this especially opened up to the artist a rich and unlimited field for the exercise of his ingenuity and skill in the art of ornament and design. The vase, too, formerly used chiefly as a ceremonial vessel of the Buddhist altar, now became a necessary object for the adornment of private life, and in its form and decoration the artist was no longer hampered by the old traditions and rules of the Church.

The founders of this period hence are not chiefly notable as in earlier times for the works destined for the services of Buddhism or the embellishment of its shrines—although many remarkable castings were made, principally standard lanterns dedicated as votive offerings to temples and monasteries, and *torii* or gate-ways of Shinto shrines—but owe their fame to the skill and fertility of design exhibited in the objects above-mentioned for household use, many of which are masterpieces of form and ornament. The following characteristic examples of Buddhist art cannot, however, be omitted from my account of this period :

1763 A.D. A fine image of Sakya Muni in the grounds of Zōjōji (Tōkyō).

1765 A.D. A colossal figure of Kwannon, nine feet to ten feet high, near the post town of Futagawa on the Tokaido.

1778 A.D. An image of Sākya Muni, seven to eight feet high, in the courtyard of Jōshinji (Tōkyō).

End of eighteenth century. An image of Amitābha, formerly at Meguro, near Tōkyō, now in the Cernuschi

Collection, Paris. Height, from the base of the lotus flower to the top of the nimbus, fourteen feet nine inches.

The period is also marked by an important naturalistic movement in the schools of both pictorial and glyptic art.

Nearly contemporaneous with the establishment of the naturalistic Shijō school of painting in Kyōtō, by the famous painter Ōkyō, we find the art founders adopting new motives and new modes of representing the old.

Stiff geometric designs give place to those based on natural forms; even in representations of the mythical dragon we see, as has been pointed out by Professor Anderson, distinct evidences of direct study of snake form.

The human figure, however, does not form part of their naturalistic studies. The forms and movements of lower animal life are expressed with a truthfulness which has never been surpassed, but in representing man they seem rarely to have been able to free themselves from the conventionalities of the art dogmas of the old Sinico-Japanese schools.

Portrait statues are of extreme rarity, those representing famous personages being merely conventional creations which are supposed to portray the type or class to which they belonged rather than the individuals themselves. A seated figure supposed to be a portrait statue of a philanthropist, Ban Kurobe, in the garb of a pilgrim would seem to be one in which an attempt has been made to produce with truthfulness a characteristic likeness of the man whom it is intended to commemorate. It was cast by Murata Kunihira in 1783 A.D., and is now in the Cernuschi Collection. Its height is two feet six inches from the top of the pedestal.

For a little more than three-quarters of a century we have another golden age in the history of bronze, during which a succession of brilliant artists, distinguished by marvellous technical skill and originality of design, worthily maintained the best traditions of the founder's art, and Japan attained a position in *cera perduta* casting which she had never reached before. Two men, Seimin (b. 1766, d. 1838) and Tōun (b. 1781, d. 1896*), stand out prominently during the closing years of the eighteenth century and the first half of the nineteenth. Others,

* The representative of the third generation, Kimura Shigesaburo Tōun, is still alive.—[ED.]

among whom should be mentioned Harutoshi, Kunihiba, Kamajo, Teijō, and Suzuki Chōkichi, approach these great masters in skill, even occasionally proving their equals. In examining their works it will be noticed that as among the painters several were specially distinguished for their skill in the representation of certain motives, Sōsen as a painter of monkeys, Ganku of tigers, Ōkyō of carp, etc.; so among the founders several are similarly renowned, thus Tōun and Sōmin for the vigour and life expressed in their dragons, and Seimin chiefly owes his fame to the perfect modelling of his tortoises. It is needless to say that they did not confine themselves to these, but executed other works not less demonstrative of their skill.

There is in the Cernuschi Collection an Incense Burner by Tōun, in the form of a Dragon grasping the Sacred Jewel. Its height is about three feet.

The following illustrations of the work of some of these artists will fully bear out what has just been stated of their marvellous skill :

Plate XXX. A Group of Tortoises by Seimin.

Plate XXVII. Vase by Teijō. (Early nineteenth century, Cernuschi Collection.)

Plate XXI. A Hawk by Suzuki Chōkichi.

A well-known example of the work of this artist is an incense burner with doves and peacocks, in the Victoria and Albert Museum, the doves especially being masterpieces of modelling, and an embodiment in bronze of the highest developments of the naturalistic school.

With the death of the last representative of this brilliant group of art founders, about the end of the first half of last century, the art gradually passed into a stage of decadence, the lowest depths of which it but recently reached, and from which it is only just emerging.

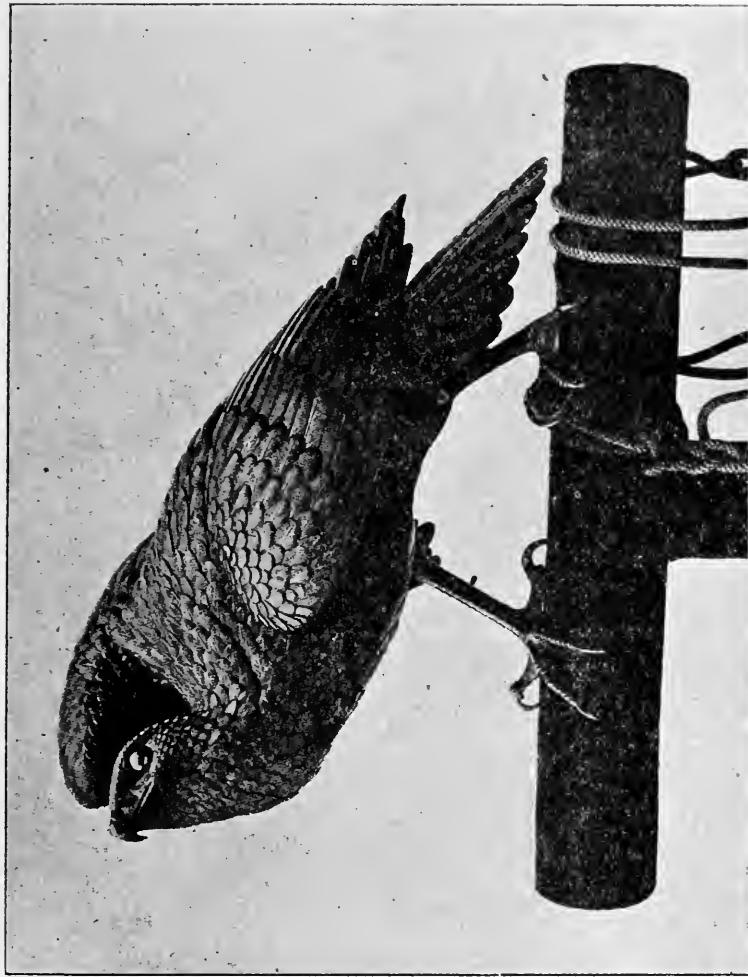
Vast numbers of bronzes have indeed been cast, but they are too often of meretricious design and tawdry ornament.

Fortunately there are a few notable exceptions to this statement. In the first decades of the second half of the century, Dōsai, Gidō, Sōmin, Jōun, Tanchosai, Toryusai, and Izan, did much excellent work, and ably sustained, under con-



GROUP OF TORTOISES. By Seimin.





HAWK. By Suzuki Chōkichi.



siderable difficulties, the best traditions of the bronze-founders' art.

I hope, in this condensed account of Metal and Metal Working in Old Japan, I have not altogether failed in demonstrating the versatility as an artist, and the skill as a handicraftsman, of the Japanese worker in metals. Correct adaptation of his designs to the nature of the material he employed, and to the forms he ornamented, distinguish all his work. And this is not only true of the great masters of bygone times, but fortunately also of a few earnest men of the present day, who are endeavouring, as far as in them lies, to follow the old craft traditions, and are not surpassed in their work by any art metal-workers in the world.

APPENDIX.

THE ALLOYS USED IN JAPAN.

The success which the Japanese artist has attained in the execution of his famous masterpieces in bronze is not, however, solely due to his methods of modelling and casting, but is largely dependent on the physical character of the alloys he has used.

His alloy *par excellence* is called *karakane*, which signifies Chinese metal—this name having been given to it because it is believed not to have originated in Japan, but to have been introduced from China.

It is quite distinct from the bronze of the earliest date of which the prehistoric halberds and swords were made, as this was a simple copper-tin alloy, whilst *karakane* contains lead as an essential constituent.

The name *karakane* does not, however, designate any definite alloy. It has a generic rather than a specific signification, and is applied to a very varied group of mixtures of metals of the copper-tin-lead series, in which the proportions of copper may range from 71 to 89 per cent., of tin from 2 to 8 per cent., and of lead from 5 to 15 per cent.

The table which follows contains all the analyses of the alloys bearing this name which have been published by various analysts, as well as some which I have made myself of typical specimens. It also includes several other allied alloys which are not in such general use as *karakane*, but are valuable for special purposes.

It will be seen from the analyses that the presence of lead as an important constituent is one of the characteristic features of the composition of the Japanese bronzes *karakane*.

The wide range in the proportions of the constituents of *karakane* is fully demonstrated by the analyses given above. This variability in composition is not solely the result of attempts on the part of the founder to produce special alloys, as might be conjectured, but is chiefly owing to the practice universally adopted of mixing considerable quantities of old metal, "scrap," of unknown composition with the furnace

ANALYSES OF JAPANESE BRONZES (*Karakane*) AND ALLIED ALLOYS.

Description	Analyst	Copper	Tin	Lead	Arsenic	Antimony	Zinc	Iron	Silver	Sulphur	Gold	Nickel	Total
1. Temple Bronze	Maumené... ...	88'70	2'58	3'54	—	'10	3'71	1'07	—	—	—	—	99'70
2. Incense Burner; eighteenth century ...	Gowland ...	86'85	1'76	9'13	1'15	'40	nil.	'33	'079	—	trace	—	99'69
3. Temple Bronze	Maumené... ...	86'38	1'94	5'68	—	1'61	3'36	'67	—	—	—	—	99'64
4. Vase, eighteenth century... ...	Geerts ...	85'3	8'9	4'7	trace	—	—	1'1	—	—	—	—	100'0
5. Cannon, eighteenth century ...	Gowland ...	84'00	12'68	3'32	—	—	—	—	—	—	—	—	100'00
6. Vase, eighteenth century... ...	Geerts ...	83'70	5'38	7'80	trace	—	—	1'85	'65	—	—	—	99'38
7. Coins, "Bunkyu," 1863 ...	Gowland ...	83'10	3'21	11'22	1'50	'49	nil.	'27	'06	'38	trace	—	100'23
8. Old Bronze Ornamental Vessels, } probably vases	Morin ...	{ 83'09	3'23	11'50	'25	—	'50	'22	—	—	—	—	98'79
9. } 10. }	82'90	2'64	10'46	'25	—	2'74	'64	—	—	—	trace	trace	99'63
11. Modern Ornament; a Tortoise ...	Roberts-Austen and Wingham	82'72	4'36	9'90	trace	—	1'86	'55	—	—	—	—	99'39
12. Coins, "Tempo," 1835-1870 A.D. ...	Gowland ...	81'62	4'61	10'21	—	—	—	—	—	—	—	—	99'08
13. Vase (?), old ...	Morin ...	81'31	8'26	9'74	'18	'03	'19	'06	'037	'08	—	—	99'887
14. Temple Bronze	Maumené... ...	81'30	3'27	11'05	trace	—	3'27	'67	—	—	—	—	99'56
15. Vase, or ornament	Kalischer ...	80'91	7'55	5'33	—	'44	3'08	1'43	—	'31	—	—	99'05
16. Vase, or ornament	Maumené... ...	7'30	4'32	15'33	1'14	'31	nil.	1'01	'06	'52	trace	—	99'99
17. Temple Bronze	Gowland ...	76'60	4'38	11'88	—	—	6'53	'47	—	—	—	—	99'6
18. Ornament	Geerts ...	72'09	5'52	20'31	trace	—	'67	1'73	—	—	—	—	100'32
19. Mirror, seventeenth or eighteenth century	Gowland ...	71'00	5'50	20'35	—	—	1'34	1'84	—	—	—	—	99'3
20. Mirror, modern	95'04	'58	3'19	'14	—	—	'04	1'13	'04	trace	—	—	100'16
21. Mirror, modern	Atkinson ...	76'28	23'64	'13	—	—	—	—	—	—	—	—	100'05
22. Bronze for Soldering Copper ...	Hochstetter Godfrey ...	75'05	16'95	7'63	—	—	—	—	—	—	—	—	99'63
23. Solder for Bronze	Hochstetter Godfrey ...	67'87	29'92	'89	—	—	—	1'19	—	—	—	—	99'87
24. Brass Coins, "Shimon-sen," 1768-1860 A.D.	Hochstetter Godfrey ...	37'04	—	1'01	—	—	61'63	'25	—	—	—	—	99'93
25. Brass Temple Vase, eighteenth century	Gowland ...	75'62	'73	2'85	1'99	'14	16'54	1'76	'016	trace	—	—	99'736
26. Yellow Bronze, "Sentoku" ...	Roberts-Austen and Wingham	74'52	'79	5'50	'12	trace	19'14	'15	—	trace	—	—	100'22
		72'32	8'126	6'217	—	—	13'102	'170	—	bismuth	—	trace	100'000

charge, even when the copper, lead, and tin of the same charge have been carefully weighed in definite proportions; a practice not altogether unknown in this country. In the case of the temple bronzes, it is generally due to their having been cast from accumulations of *ex voto* offerings of the most heterogeneous character.

The presence of arsenic and antimony, both of which are often found in considerable amounts in these alloys, is not due to the use of impure metals, but to the addition of a pseudo-speise called "*shiomé*," a by-product of the desilverization of copper by lead.* It was added to the alloy in order to increase its hardness without diminishing its fusibility, and to obtain in the castings a sharper impression of the mould than was possible with the copper-tin-lead alloy alone. During later years it has been used by some bronze-founders because its addition to *karakane* has been found to facilitate the production of the grey patina, which is preferred for objects which have to be decorated with inlaid line designs in silver.

It is almost needless to say that silver, although mentioned in temple records as having been added to the bronze used for the casting of some of their famous images and bells, has never been so added, as there is never more present than can be accounted for by its occurrence in the copper, lead, or *shiomé* used.

Mercury and gold, which are also erroneously recorded as constituents of some noted bronzes, do not exist in the alloy, and can only have been used for gilding their surfaces.

The chief characters on which the value of the Japanese copper-tin-lead alloys, as art bronzes, depend may be briefly stated as follows:

1. Low melting point. This is of especial importance to the Japanese founder, owing to the fusible nature of the clays and sands of which his crucibles and moulds are made.
2. Great fluidity when melted, compared with the sluggishness of copper-tin bronzes.
3. Capability of receiving sharp impressions of the mould.
4. Their contraction on solidification is not excessive.
5. Their peculiar smooth surface.

* Gowland, "A Japanese Pseudo-speise," *Jour. Soc. Chemical Industry*, vol. xiii., p. 463.

6. The readiness with which they acquire rich patinas of many tints when suitably treated.

The advantages resulting from the above properties will be obvious to all artists in bronze. They are chiefly the result of the use of lead as one of the chief constituents of the alloys. The low melting point of these bronzes, their fluidity when melted, and the facility with which they acquire certain patinas are, indeed, entirely due to the use of this metal. The fine velvety surface and sharpness of the castings depend in a great measure on the structure of the mould and its comparatively high temperature when the bronze is poured into it, although partly also on the influence of the lead.

The other alloys, which are not contained in the *karakane* group, do not require a lengthy consideration, as they are much less frequently made use of by artists.

Thus the simple copper-tin alloys, which were employed in prehistoric times, are not found in use after the introduction of *karakane* from China until comparatively recently, and then only occasionally for mirrors.

Neither have the copper-zinc alloys “*shinshu*” or brass (Table, Nos. 24 and 25) been much in favour among artists.

They were unknown in Japan before the establishment of Buddhism, and were probably introduced contemporaneously with that religion from China.

Their use in art has been almost exclusively restricted to the production of the ceremonial vessels and utensils of temples and shrines, and especially for the “*Go-gusoku*” or “Five ornaments of the Buddhist altar.”

Even when a yellow metal is needed for the purposes of decorative ornament brass is seldom used, copper coated with gold being preferred, the rich colour and quality of the gold surface being more pleasing to the eye than the harsher tones of the copper-zinc alloy. Hence there is scarcely a single example in the country of any great work of art executed in brass.

Occasionally the yellow bronze “*sentoku*” (Table, No. 26), consisting of copper, tin, and zinc—an alloy occupying an intermediate position between *karakane* and brass—is used instead of the latter alloy. It is, however, probably not older than the fifteenth century. An old Chinese legend records that it was accidentally discovered after the destruction of a temple by fire, when the bronze vessels, brass and gold, of the altar

were melted together into a mass. The beautiful colour of the metal attracted the attention of some art founders, who, after numerous unsuccessful attempts, at last succeeded in producing an alloy resembling it. Gold is said to be an essential ingredient in its composition, but I have not found any in the specimens I have examined.

It is not in very common use. Vases and other objects cast of it—generally with but little ornament in relief—are occasionally met with, but the finest specimens are found among the guards and other ornamental furniture of the sword, and all are chiefly notable as examples of chasing rather than of founding, or for the beautiful colour and texture of their surfaces.

SHAKUDO AND SHIBUICHI.

These alloys, *shakudo* and *shibuichi*, are peculiar to Japan. They are not found in China or any other part of the Far East, in fact, not in any other country in the world. There is nothing specially beautiful in the alloys themselves as simply cast, and their value as decorative alloys is entirely dependent on the patinas which can be produced on their surfaces by suitable treatment.

Shakudo.

Shakudo is, as I have stated above, a purely Japanese alloy. An alloy in which gold is an important constituent is said by M. Paleologue to have been in use in China. The composition, as he gives it, is not very intelligible. It is as follows: Copper 100 parts, tin 30 parts, and gold $\frac{2}{5}$ of an ounce. In whatever way we interpret this, the proportions of gold present must be very small. Yet he states that it is employed for making vases, to the surface of which a beautiful tint is given by immersion in a solution consisting of vinegar of plums, verdigris, and water. The patina produced by this treatment of such an alloy is entirely distinct from that of *shakudo*, and the metal itself cannot be considered even as a variety of the Japanese alloy.

Shakudo is sometimes called “*U-kin*,” signifying “cormorant gold,” from the black colour of its patina. But when simply cast, and without any treatment of its surface, it is of a dark copper colour, differing but little in appearance from ordinary bronze.

Its composition is given in the following table of analyses:

ANALYSES OF THE ALLOY "SHAKUDO."

	Gold	Silver	Copper	Lead	Iron	Arsenic	Total	Analyst
1	4.16	0.08	95.77	...	...	...	100.01	Kalischer
2	3.73	1.55	94.50	0.11	Trace	Trace	99.89	Gowland
3	2.67	2.06	94.90	0.11	...	...	99.74	"
4	2.45	1.24	96.00	0.06	...	...	99.75	"
5	1.52	2.01	96.10	0.08	...	...	99.71	"
6	1.00	1.37	97.40	0.07	...	...	99.84	"
7	0.49	0.29	99.04	...	...	...	99.82	Atkinson

The presence of not less than about 4 per cent. of gold is absolutely essential to obtain the finest black surface with violet sheen, which is seen in the choicest specimens of the alloy. There are, however, according to the classification of the Japanese craftsmen, not less than fifteen grades of *shakudo*; the lowest, which is known as "*chūshō*," contains only traces of gold. The *shakudo* of the Satsuma craftsmen is generally considered to be the richest and most valuable, although that used by Ishiguro Masatsune, of Yedo, and by one or two others, approaches and often equals it in excellence.

The alloy has been long known to the Japanese, but there are no records of its first use, and the date of its origin cannot be even approximately determined.

Perhaps the least doubtful of the earliest specimens are the guard of a Mitsutada sword (middle of the thirteenth century), and the mounts of the sword of Ashikaga Takauji, who held the position of shogun from 1335 to 1357 A.D., which are preserved in the treasure house of the temple of Itsukushima.

There may be earlier examples, but it was certainly not known in the ninth century.

The oldest specimen of Buddhist art metal-work in the decoration of which *shakudo* appears, so far as I have been able to trace, is a reliquary containing fragments of the bones of St. Nichiren in the famous temple of Minobu (date, 1580).

In many temples there are statues of divinities and saints which are said to be composed of this alloy, but those I have had an opportunity of examining were all of ordinary copper-tin-lead bronze.

In fact, *shakudo* was never employed for large castings.

The finest examples of its use as a decorative alloy are found in the guards and other furniture of the sword, from the

time of Goto Shirobei (1439 to 1512 A.D.), the first of the famous line of art workers in metal, up to the last Goto, about the middle of the nineteenth century.

The true *shakudo*—*i.e.* the alloy which contains about 4 to 5 per cent. of gold—is unapproached in the beauty of its patina by any other alloy. Its deep rich tones of black, and the splendid polish which it is capable of receiving, render it alike a perfect ground for inlaid designs of gold, silver, and copper, and for being similarly inlaid in them.

This alloy, too, possesses physical properties which are of extreme importance to the worker in metals, and enables him to manipulate and fashion it as he desires. It can be cast into any form, can be hammered into sheets, and drawn into wire.

The method by which the black patina is produced is as follows: The object is first boiled in a lye prepared by lixiviating wood ashes, after which it is carefully polished, if necessary, with charcoal powder. It is then immersed in plum-vinegar containing common salt in solution, and after being washed with a weak lye, is placed in a tub of water to remove all traces of alkali. After this treatment it is digested in a boiling solution of copper sulphate, verdigris, and water, to which sometimes potassium nitrate is added, until the desired patina is produced.

The Japanese are still adding to the number of their curious alloys, the last addition being a variety of *shakudo* containing no gold. It has been introduced by my friend and former assistant Mr. Y. Koga, now Superintendent of the Imperial Mint, for the preparation of medals for the soldiers who took part in the war with China. It was decided by the Government that these medals should be made from the bronze guns which had been captured from the Chinese, but that "they must not present an undignified appearance like a cheap copper coin," but must have a black patina resembling *shakudo*. After several experiments he succeeded in producing an alloy with the desired patina by adding to the bronze of the guns small quantities of an iron-arsenic-speise termed "*bajirome*," containing 60 per cent. of iron and 32 per cent. of arsenic. The medals, after being struck and carefully burnished, are boiled in a solution of the following composition:

Copper sulphate	...	...	2·5 grms.
Verdigris	...	...	8·3 "
Water...	...	...	2·0 litres.

After this treatment they possess a very fine black patina, almost rivalling that of *shakudo*. The above solution does not differ very much from those generally used for *shakudo*, but it possesses this great advantage, that the burnished surface of objects treated by it is not in the least impaired.

Shibuichi.

Of equal importance with *shakudo* in ornamental metal-work is the alloy of copper and silver called "*shibuichi*." Its name denotes that it consists of one part of silver in four of the alloy—*i.e.* one part of silver is alloyed with three parts of copper; but it is rather a generic than a specific name, as under it must be included, not only two other definite alloys—viz. "*sambo-gin*," consisting of one part of silver to two parts of copper—and "*hoji-gin*," composed of equal parts of each metal, but also several lower and intermediate alloys. And, in fact, the alloy most generally employed by the chief art metal-workers was not *shibuichi*, in the strict meaning of the term, but *sambo-gin*.

The composition of the members of this group of alloys is given in the following table :

ANALYSES OF SILVER ALLOYS OF THE "SHIBUICHI" GROUP.

	Hoji-gin		Eiji-gin	Sambo-gin		Shiho-gin	Ansei-gin
	1. Mint Trade Bars. 1706 A.D. (Gowland).	2. Sword Mount (Kalischer).	3. Mint Trade Bars. 1710 A.D. (Gowland).	4. Mint Trade Bars. 1710 A.D. (Gowland).	5. Sword Mount. Early 18th century (Gowland).	6. Mint Trade Bars. 1711 A.D. (Gowland).	7. Mint Trade Bars. 1854 A.D. (Gowland).
Silver...	50'70	48'93	41'60	32'65	32'07	20'40	13'50
Copper	49'18	51'10	58'32	67'27	67'31	79'58	86'48
Gold ...	0'12	0'12	0'08	0'08	Trace	0'02	0'02
Lead ...	...	...	...	...	0'52	...	...
	100'00	100'15	100'00	100'00	99'90	100'00	100'00

It will be observed that there is a great range in the proportions of silver present, from 13·5 to 50·7 per cent. The value of this alloy in decorative metal-work is, like that of *shakudo*, entirely dependent on its patina. It possesses no special beauty when cast, its colour being that of pale gun-metal, or a common pale bronze, but when its surface is subjected to appropriate treatment it assumes a patina of charming shades of grey, which gives it a unique position among art alloys. No other affords the artist such a delicate, unobtrusive, and effective ground for inlaid designs of gold, silver, or other metals.

Shibuichi is said to have been in use in the Ashikaga Period (1338-1573). In the seventeenth century we have several specimens, notably a *kogai* by Goto Tokujo (1631), and a *kozuka* by Goto Junjo (1699), whilst in the eighteenth and nineteenth centuries it appears to have been largely employed for sword mounts generally.

The first official record of the alloy only dates from the beginning of the eighteenth century (1706 A.D.), when it was used in the Government Mint for the preparation of debased silver bars, termed "*chō-gin*" (trade silver), which were used for commercial purposes.

In some of the examples of its use in sword-guards, about the same date, it seems to have been chiefly employed as a substitute for a richer alloy, a pure silver surface having been given to it by the process I have already described (p. 32), and not the fine grey patina of later times. The patina is produced by precisely the same operations which are practised for *shakudo*, the solution in which the objects are boiled having the same composition as that used for the arsenical bronze, with the addition of 1 c.c. plum-vinegar to each litre. I may say that all the alloys given in the table of analyses, including No. 7, yield a grey patina when treated with this solution, but the finest grey tints are only obtained with those containing from 33 to 50 per cent. of silver.

By the use in his designs of both these classes of alloys—*shakudo* and *shibuichi*—together with gold, silver, copper, and iron, the Japanese craftsman has achieved results in colour which are unrivalled in the metal-work of the world.

The Chairman, SIR C. HERCULES READ: The paper that we have heard to-night from Prof. Gowland dealing with all the principal metals over a period of 2,200 years or more must very naturally lend itself, if time serves, to a good deal of interesting argument and discussion. We have here one or two people who are *au fait* with questions of this sort, notably Mr. Joly, who is specially competent of dealing with this particular matter, and whom I will call upon to open the discussion.

Mr. H. L. JOLY: I understood that I would be called upon to move the vote of thanks to the lecturer, and as it would have been a great pleasure for me I would ask permission to still do so whilst complying with the request expressed from the Chair in terms far too complimentary to myself. Yet I feel that I cannot open a discussion on the paper because first of all it has been read in abstract

only, indeed probably less than half has been delivered to-night, and further because when I began to study Japanese matters Prof. Gowland was already a past master in the art. It may be said that to him and to Dr. Munro the Japanese owe the beginnings of their scientific investigations in the archaeology of their own country, and particularly of the remains of the earlier protohistoric culture. Much has been done in that direction since Prof. Gowland left Japan, and read before various learned Societies papers on Japanese dolmen sepultures and the evolution of metallurgy and metal handicrafts in Nippon. However, it almost seems as if Prof. Gowland had either a dowsing stick—or the luck which often favours some early workers in any field of research—for the number of metal relics yielded by the tumuli which he opened was comparatively far greater than has been the case since. As at the present time I do not know the actual unread contents of the paper, I do not propose then to introduce controversial matter, but I may deal rapidly with a few points. The Bell-like *Dotaku* have been the subject of considerable discussion by Y. Numata, Y. Ogawa, T. Iwai, Prof. Tsuboi, and others, particularly by comparison with articles of the Chou dynasty of China.* The study of old bronzes, and the dating of early pieces of metal work have been gone into since the National Treasures have been catalogued, and since examples once hidden from the public have been made more readily accessible. With regard to the Swords, the long straight blade was, I think, the weapon of the invaders in the second migration, when tribes entered Kyushu, presumably from the Malay islands; anyhow, tribes different from the earlier settlers in Izumo, who appear to have carried only short weapons; the straight

* It may be added here that, according to the consensus of opinion amongst the above-named Japanese archaeologists, the *Dotaku* were actually used as bells and most likely in the ceremonial "praying for rain." They have been found chiefly in the central provinces, Gokinai, Shikoku Island, Mikawa, and Totomi, and it may be noted that both in Kishu and Sanuki specimens were found in "praying for rain mounds;" moreover two found in Tosa were described as *Améfurigané* (Rainfall bell). None have been found in China or in Korea. Their decorative designs in extremely low relief are somewhat similar with those found on bronze drums used by the Miao Tzu—namely, birds, houses, boats, man pounding rice. It was once thought that they were struck with a wooden or a padded tongue hung inside, and as some specimens show traces of having been struck on the inner surface, Mr. Numata is of opinion that the tongue was hung on a wooden cradle, the outer members of which were fastened through the holes at the top of the bell. The question is still unsettled. The earliest record of a find dates from the seventh year of the reign of Tenchi Tenno, when a *Dotaku* was found at a depth of five and a half feet whilst the foundations of the temple Sofukuji were being dug; it was accompanied by a "white stone which was luminous at night" (? Fluorspar). *Dotaku* are always found alone; only one exception is recorded in the Meiji Period when a *tsurugi* was found with one of them; this is a further argument in favour of the rain-bell theory.—[H. L. J.]

blade forged from steel and iron in layers is still a Dayak weapon. The Formosan sword is also straight, both present characters found in early Japanese swords, and further one may note that the Tibetan sword is very much akin to the Japanese swords of the dolmen period, both in texture and shape. The Society will welcome in its Transactions this extensive paper containing so much material, a part of which has hitherto been communicated only to other bodies having no special connection with Japan, and I have pleasure in asking the meeting to accord to the author a sincere vote of thanks for his paper, and for the enormous amount of trouble which he has taken to illustrate it with slides, photographs, and wall diagrams, dealing with the subject, not only as a metallurgist but also from the varied points of view of the archæologist and the art lover.

Mr. WILSON CREWDSON : I have great pleasure in seconding the vote of thanks. It has been for many years my desire to hear a lecture from Prof. Gowland on this subject. All who have read what he has written must want to hear more, and I congratulate our Society very heartily on having had the privilege of listening to him. Amongst other things I was particularly interested in his description of bells ; it is interesting to contrast the mass of the temple bells with the small bells made for horses, cats, hawks, etc., the latter being marvellously light and resonant.

I would like to ask Prof. Gowland if the tumulus in Japan was always of the same type, or if it differed in its construction as it did in other countries ?

Mr. ARTHUR DIÓSY : I have only got one question to ask, and that is on the subject of bells. It is whether Prof. Gowland could tell us anything about the connection of those ancient bells in Japan with forms of worship and ritual?—because on the Asian mainland bells of that description are used extensively, and bells in Japan were certainly considered to be a very important article in ancient times.

Prof. GOWLAND : With regard to the question that has been asked concerning the tumuli, of course there were three distinct kinds. First we have the simple kind, which was circular in form ; then we have the elongated kind, which has something of an oval form ; and then we have the imperial kind, which last-mentioned is a thing by itself. The old mounds have been called double mounds, although they were not really double, because they have really been weathered into such a form that they appear to be double. The circular mounds are small as a rule ; the elongated mounds are large and contain very large dolmens ; some of them probably will have dolmens about sixty feet in length. The imperial mounds all contain dolmens, and the curious thing is that, as a rule, the bigger the mound, the smaller the dolmen. This is a very curious thing,

one finds, for instance, a mound which is probably nearly a hundred yards long, and about sixty feet high, and the dolmen contained within it will be less than the dolmen in an ordinary elongated mound. Adverting to some of the larger mounds—one more particularly, which was not recognised as an imperial mound until I pointed out to the Governor of the province that it was decidedly imperial—well, this mound was so large that there was a part of the village built upon it, and it was entirely under cultivation. The dolmen that it contained had a gallery sixty feet in length, and a chamber sixteen feet square, the chamber containing two sarcophagi. Here you have a splendid mound, really one of the largest in Japan, and it is quite forgotten; there is no trace whatever of any religious practice in regard to it, and it is not connected with any name.

With regard to bells. I suppose Mr. Diósy's reference was to those bells which I said were disputed by archæologists. I know that the bells of which Mr. Diósy speaks are not used in the circumstances that he mentions. But the curious thing with regard to these bells is this, that they are of extreme thinness. That bell, which is four feet six inches in height, is not more than $\frac{3}{16}$ of an inch in thickness. There are no signs of its having been hung or of its having been used as a bell, "that is, struck with a clapper from inside or outside." I have had many discussions with the curator of the Imperial Museums in Tokyo on this subject. He said that these things had been used as bells, but when I had taken him round and examined them, he agreed with me that none of them had been so used.

The CHAIRMAN : I only have one pleasant duty to perform, and that is to ask you to endorse the vote of thanks that has been so ably put by Mr. Joly and Mr. Crewdson.

But I want to say a few words myself, and as there is no one who can ask me to do so, I am going to impose myself upon you for a few moments. I think we ought to be, and are, greatly indebted to Prof. Gowland, first of all for having written what I have no doubt is a thoroughly comprehensive paper on this very fascinating subject, of which he is a past master, and then we owe him a debt, I think, in some senses even greater than that, for having undertaken the condensation of his paper, so as to bring it within the limits of a meeting such as this. It may be a simple matter to write down everything one knows on a subject, but it is difficult to condense it so that it may be read in a given time.

My own method in dealing with matters of this sort, metallurgy and so on, is invariably the comparative one, for I have had to do with the metallurgy and objects of metal of all parts of the world, and almost all races, and what has struck me most with

regard to Prof. Gowland's paper this evening is the extreme difference in many ways between the early metal ages in the East and in the West. We are inclined, most of us, colloquially and socially, without thinking very much about it, to assume that the East is very much older than the West, and that the early civilisation of the East is a thing very much more remote than anything we can lay claim to. But, as Prof. Gowland has shown you to-night, this is not entirely true. The rarity of gold in Japan I must say I was not so sure about as I am now, after having heard Prof. Gowland, but our islands, and Ireland particularly, were sources of gold for all Europe many years before our era. On the other hand, in Europe generally, limited by the Mediterranean in the south and Scandinavia in the north, silver was a very considerable rarity, while gold was comparatively common.

It is very bold of me to talk in this way of early metals with Prof. Gowland sitting on my left, but I know he is a very kind man, also he is not allowed to reply.

The ingot which Prof. Gowland showed us on the screen is convex at the two ends and concave at the sides.* It is an odd coincidence that it has almost precisely the form of the Roman ingot used in this country and probably in Rome itself, although I do not remember one, but certainly in the Roman colonies of the second and third centuries of our era. It is certainly very curious that the ingot should be the same shape in Japan and, in Roman times, in Britain and in Gaul. It will be suggested that when you have masses of metal of definite weights they may be made in a shape with concave sides, so that a cord or thong can be passed round the bars and they can be easily transported.

One other point struck me as I was coming here to-night, and it is quite as curious. You all know that Prof. Gowland was obliged to leave out all the accounts of the mediæval sword. One of the common features of Japanese swords is that the edge is of hardened steel and the back or body of the sword remains unhardened, the object, of course, being that the edge may be of excessive keenness. Now that precise method of making swords was used in Europe also, from the fourth to the second century B.C., by a Celtic people who were living in Central Europe. It was my good fortune to be able to examine one of these swords which was presented to the British Museum by a member of the Japan Society who is much too modest to allow me to mention his name,† and I pointed out this peculiarity in the making of the sword. It is

* *Homa*, see fig. 5, p. 30. This shape is also associated with Japanese weights, *Shitogi* cakes in the Shintō ritual, and with ancient Chinese waffle-irons.—[ED.]

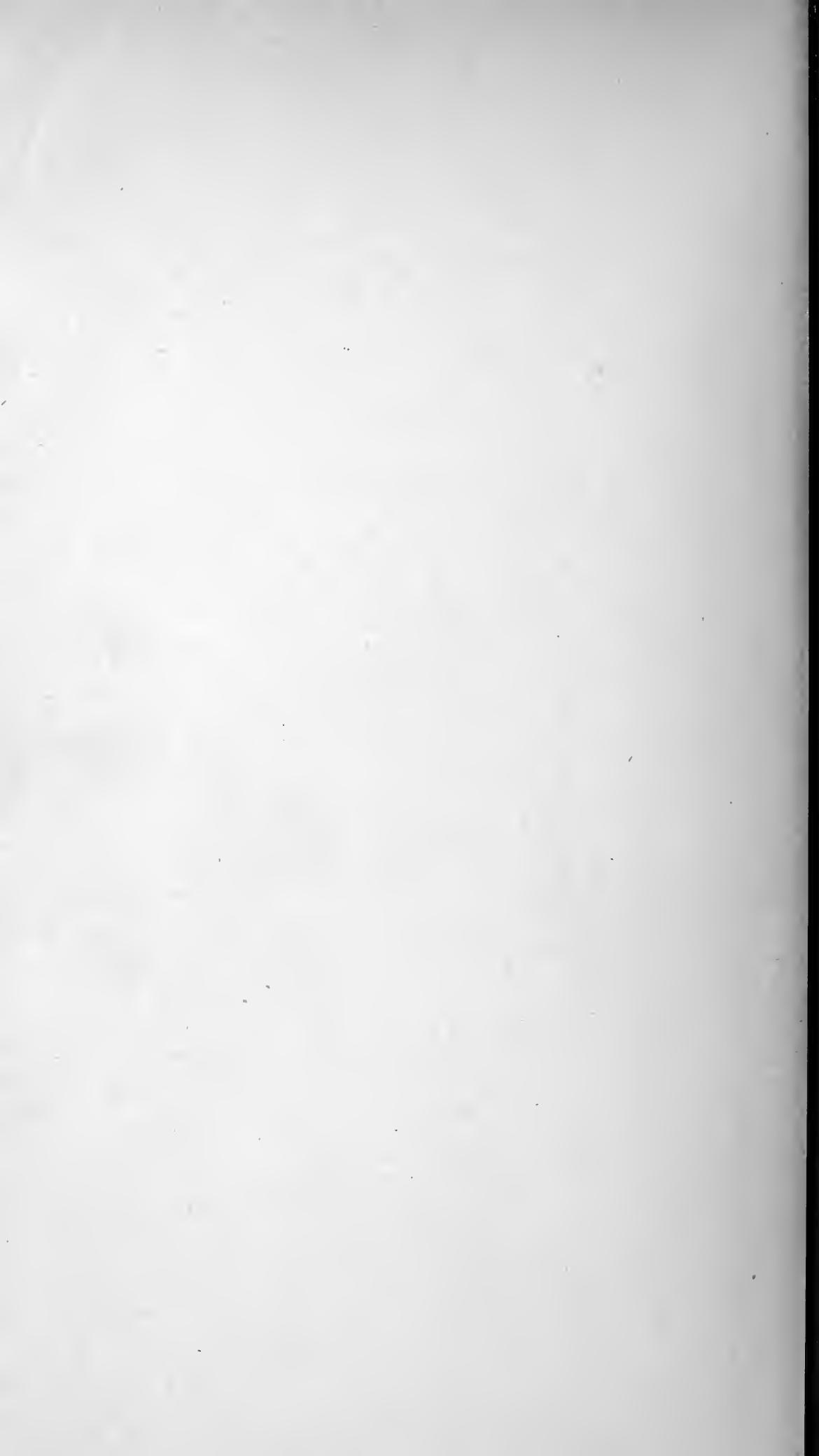
† Mr. Oscar C. Raphael.—[ED.]

worthy of note that we have these two common features in Europe and Japan at a period of 200 B.C. in the instance of the sword and 200 A.D. in the instance of the ingot, which seems to bring the two ends of the earth together in their technical processes.

I think that one point should not be overlooked, and that is that Buddhism had as much influence in fostering the arts in Japan, and, of course, also in China, as Christianity had in Europe and the West. If you think of it, the richness of decoration, the necessities of ritual, in one and the other, must necessarily, and in fact did, bring out all the best qualities in the artists living in those several countries at the time. Whether the Impressionism of to-day, which is condemned by the more conservative artists, is due to the absence of a religion, it is not for me to say. But these things psychologically are not negligible. Cause and effect are often taken one for the other, and to distinguish them is not by any means an easy task.

I will now ask you to give your hearty thanks to Prof. Gowland for his very admirable lecture this evening.

After acknowledgment by Prof. GOWLAND, a cordial vote of thanks was tendered to the Chairman on the motion of Messrs. W. HARDING SMITH and W. L. HILDBURGH.



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